SCIENTIFIC RESULTS OF CRUISE VII OF THE CARNEGIE
DURING 1928-1929

METEOROLOGY—I

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WOODROW C. JACOBS AND KATHERINE B. CLARKE

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DEPARTMENT OF TERRESTRIAL MAGNETISM
J. A. Fleming, Director

Scientific Results of Cruise VII of the CARNEGIE during 1928-1929
under Command of Captain J. P. Ault

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PREFACE

Of the 110,000 nautical miles planned for the seventh cruise of the nonmagnetic ship Carnegie of the Carnegie Institution of Washington, nearly one-half had been completed upon her arrival at Apia, November 28, 1929. The extensive program of observation in terrestrial magnetism, terrestrial electricity, chemical oceanography, physical oceanography, marine biology, and marine meteorology was being carried out in virtually every detail. Practical techniques and instrumental appliances for oceanographic work on a sailing vessel had been most successfully developed by Captain J. P. Ault, master and chief of the scientific personnel, and his colleagues. The high standards established under the energetic and resourceful leadership of Dr. Louis A. Bauer and his coworkers were maintained, and the achievements which had marked the previous work of the Carnegie extended.

But this cruise was tragically the last of the seven great adventures represented by the world cruises of the vessel. Early in the afternoon of November 29, 1929, while she was in the harbor at Apia completing the storage of 2000 gallons of gasoline, there was an explosion as a result of which Captain Ault and cabin boy Anthony Kolar lost their lives, five officers and seamen were injured, and the vessel with all her equipment was destroyed.

In 376 days at sea nearly 45,000 nautical miles had been covered (see map p. 145). In addition to the extensive magnetic and atmospheric-electric observations, a great number of data and marine collections had been obtained in the fields of chemistry, physics, and biology, including bottom samples and depth determinations. These observations were made at 162 stations, at an average distance apart of 300 nautical miles. The distribution of these stations is shown in map, which delineates also the course followed by the vessel from Washington, May 1, 1928, to Apia, November 28, 1929. At each station, salinities and temperatures were obtained at depths of 0, 5, 25, 50, 75, 100, 200, 300, 400, 500, 700, 1000, 1500, etc., meters, down to the bottom or to a maximum of 6000 meters, and complete physical and chemical determinations were made. Biological samples to the number of 1014 were obtained both by net and by pump, usually at 0, 50, and 100 meters. Numerous physical and chemical data were obtained at the surface. Sonic depths were determined at 1500 points and bottom samples were obtained at 87 points. Since, in accordance with the established policy of the Department of Terrestrial Magnetism, all observational data and materials were forwarded regularly to Washington from each port of call, the records of only one observation were lost with the ship, namely, a depth determination on the short leg from Pago Pago and Apia.

The compilations of, and reports on, the scientific results obtained during this last cruise of the Carnegie are being published under the classifications Physical Oceanography, Chemical Oceanography, Meteorology, and Biology, in a series numbered, under each subject I, II, III, etc.

A general account of the expedition has been prepared and published by J. Harland Paul, ship's surgeon and observer, under the title The last cruise of the Carnegie, and contains a brief chapter on the previous cruises of the Carnegie, a description of the vessel and her equipment, and a full narrative of the cruise (Baltimore, Williams and Wilkins Company, 1932; xiii + 331 pages with 198 illustrations).

The preparations for, and the realization of, the program would have been impossible without the generous cooperation, expert advice, and contributions of special equipment and books received on all sides from interested organizations and investigators both in America and in Europe. Among these, the Carnegie Institution of Washington is indebted to the following: the United States Navy Department, including particularly its Hydrographic Office and Naval Research Laboratory; the Signal Corps and the Air Corps of the War Department; the National Museum, the Bureau of Fisheries, the Weather Bureau, the Coast Guard, and the Coast and Geodetic Survey; the Scripps Institution of Oceanography of the University of California; the Museum of Comparative Zoölogy of Harvard University; the School of Geography of Clark University; the American Radio Relay League; the Geophysical Institute, Bergen, Norway; the Marine Biological Association of the United Kingdom, Plymouth, England; the German Atlantic Expedition of the Meteor, Institut für Meereskunde, Berlin, Germany; the British Admiralty, London, England; the Carlsberg Laboratorium, Bureau International pour l'Exploration de la Mer, and Laboratoire Hydrographique, Copenhagen, Denmark; and many others. Dr. H. U. Sverdrup, now Director of the Scripps Institution of Oceanography of the University of California, at La Jolla, California, who was then a Research Associate of the Carnegie Institution of Washington at the Geophysical Institute at Bergen, Norway, was consulting oceanographer and physicist.

In summarizing an enterprise such as the magnetic, electric, and oceanographic surveys of the Carnegie and of her predecessor the Galilee, which covered a quarter of a century, and which required cooperative effort and unselfish interest on the part of many skilled scientists, it is impossible to allocate full and appropriate credit. Captain W. J. Peters laid the broad foundation of the work during the early cruises of both vessels, and Captain J. P. Ault, who had had the good fortune to serve under him, continued and developed that which Captain Peters had so well begun. The original plan of the work was envisioned by L. A. Bauer, the first Director of the Department of Terrestrial Magnetism, Carnegie Institution of Washington; the development of suitable methods and apparatus was the result of the painstaking efforts of his co-workers at Washington. Truly, as was stated by Captain Ault in an address during the commemorative exercies held on board the Carnegie in San Francisco, August 26, 1929, "The story of individual endeavor and enterprise, of invention and accomplishment, cannot be told."

On the last cruise of the Carnegie, meteorological observations formed an important part of the work. In formulating the program in meteorology, the Department was privileged by the consultation, advice, and guidance of Chief C. F. Marvin of the United States Weather Bureau and various members of his staff, by Professor C. F. Brooks, Director of the Blue Hill Meteorological Observatory, and by Dr. H. U. Sverdrup of the Geophysical Institute of Norway at Bergen, also associated with the Carnegie Institution of Washington as Research Associate. Dr. Sverdrup gave additional constructive counsel during the visit to Hamburg, Germany, of the Carnegie early in the cruise. At Hamburg additional meteorological equipment was installed with the help and advice of

Dr. Erich Kuhlbrodt, then of the Deutsche Seewarte, who had charge of the meteorological work done on the Meteor Expedition. Daily determinations in accordance with standard forms supplied by the United States Weather Bureau, continuous records of certain of the elements, and some experimental developments of apparatus were made throughout the cruise by members of the scientific staff of the Carnegie, particularly J. H. Paul and O. W. Torreson.

The data resulting from the observations and records of atmospheric pressure, air temperature, sea-surface temperature, humidity, evaporation, and miscellaneous meteorological phenomena were reduced, tabulated, and analyzed at the Department of Terrestrial Magnetism in Washington during 1931-1933 by Katharine B. Clarke. She prepared accounts of the preliminary results of several aspects of the discussions of the material for presentation before meetings of the American Geophysical Union, the American Meteorological Society, and the Fifth Pacific Science Congress, and these were published in various scientific journals. Miss Clarke had the advice and guidance of Professor Brooks throughout.

The preliminary tabulations and discussions were later submitted for critical examination to Dr. H. U. Sverdrup, who meanwhile had become Director of the Scripps Institution of Oceanography of the University of California and who had continued as consultant on the oceanographic and meteorological work of the Carnegie. After careful review, he entrusted the preparation of the final manuscript and discussion to his assistant W. C. Jacobs of the United States Weather Bureau, who in consultation with Dr. Sverdrup and Miss Clarke prepared the manuscript for final publication. The final manuscript was received in Washington in August 1938; thus pertinent papers printed since then were not considered. To the combined efforts of all the above mentioned investigators and the cooperation of their respective institutions we are indebted for a valuable contribution to marine meteorology.

The present volume is the fourth in the series of "Scientific results of cruise VII of the Carnegie" and is the first of the Meteorological Reports.

J. A. Fleming
Director, Department of Terrestrial Magnetism

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INTRODUCTION

The meteorological data which are discussed here comprise the ordinary meteorological observations taken on board the nonmagnetic ship Carnegie during its seventh cruise (1928-1929). The Carnegie had become well known to scientists throughout the world for its magnetic surveys of all oceans during six previous cruises from 1909 to 1921. Before embarking on the seventh cruise, however, the vessel was refitted and equipped for special oceanographic and meteorological work, as well as for magnetic and atmospheric-electric observations. The ship was primarily a sailing vessel (600 tons) with hermaphrodite brigantine rig, but also had an auxiliary motor capable of developing 6 knots. The crew consisted of seventeen men; the scientific staff, including Captain J. P. Ault, numbered eight, two of whom, Dr. J. H. Paul and Oscar W. Torreson, handled the meteorological work as part of their duties.

The route covered by the Carnegie and the uncompleted parts of the cruise are shown in figure 1. It was originally intended that the cruise should occupy the greater part of three years (from May 10, 1928, through 1931), but this program was abruptly halted when the vessel caught fire and burned while anchored at Apia, Western Samoa, November 29, 1929.

Complete meteorological observations and records of sea-surface temperature and of the state of the sea were made each day at noon (GMT), the data being entered on forms supplied by the U. S. Weather Bureau. One copy of these forms was forwarded to the Weather Bureau and another was retained on the Carnegie. The complete series of these noon observations is given in tabular form as appendix II of this report (table 76).

In addition to the observational work outlined above, the meteorological program of the Carnegie called for continuous recording of atmospheric pressure, sea-surface temperature, and wet- and dry-bulb temperatures on deck and at two levels above the deck, and for periodic measurements of evaporation and the determination of upper-air winds by means of pilot balloons. Also, at each watch the ship's officer entered a record of prevailing and special weather conditions in the log; most unfortunately, the original logbook was destroyed with the Carnegie. Abstracts of the log had been prepared and mailed to the Department of Terrestrial Magnetism, Washington, D. C., each time the Carnegie touched port. This abstract has been extremely useful in determining average weather conditions for certain days of the cruise and for locating positions. The abstract is included in this report as appendix I.

In order to facilitate regional studies of the Carnegie data, the route covered by the cruise has been divided into twenty-two parts, which have been chosen on the ba-

Table 1. Groups used in compilation and discussion of meteorological data, Carnegie, 1928-29

Group	Region	Dates[a]	No. days	Mean	
				Latitude	Longitude
		1928		°	°
I	South Greenland	July 29-Aug. 6	9	56.3 N	40.7 W
II	Southeast Newfoundland	Aug. 7-10	4	42.8 N	47.8 W
III	Southwest Azores	Aug. 11-23	13	29.0 N	42.0 W
IV	Northeast Venezuela	Aug. 24-Sep. 16	24	11.8 N	43.0 W
V	Caribbean	Oct. 2-10	9	13.8 N	71.0 W
VI	Gulf of Panama	Oct. 26-Nov. 6	12	4.0 N	81.0 W
VII	Galápagos				
(a)	Easter Island	Nov. 7-Dec. 21	38 } 49	16.5 S	104.3 W
		1929			
(b)	Easter Island	Feb. 18-28	11 }	13.1 S	119.4 W
		1928			
VIII	Southwest Juan Fernández	Dec. 22-31	10	37.2 S	96.7 W
		1929			
IX	Chile	Jan. 1-14	14	24.7 S	83.3 W
X	West Callao	Feb. 6-17	12	12.3 S	88.2 W
XI	Tuamotu	Mar. 1-31	24	16.8 S	147.9 W
XII	Marianas				
	Phoenix Island	Apr. 22-May 31	35	9.7 N	168.7 E
XIII	Japan				
(a)		June 1-30	14 } 17	34.3 N	143.1 E
(b)		July 1-3	3 }	39.6 N	149.4 E
XIV	Alaskan Peninsula	July 4-21[b]	19	47.7 N	179.5 W
XV	Northwest America	July 22-28	7	41.5 N	131.8 W
XVI	California	Sep. 4-8	5	34.1 N	126.3 W
XVII	Hawaii				
(a)		Sep. 9-16	8 }	27.8 N	136.6 W
(b)		Sep. 17-Oct. 7	12 } 38	27.0 N	155.1 W
(c)		Oct. 8-25	18 }	25.2 N	140.7 W
XVIII	Christmas Island	Oct. 26-Nov. 18	24	0.1 S	150.5 W
	Total days		325		

[a] Days omitted as follows: Dec. 6-12, 25 in 1928: Mar. 13-20, May 6, 21-24, June 8-23, Sep. 23-Oct. 1 in 1929. [b] Including two dates July 14 on crossing 180° meridian.

sis of the similarity of sea-surface temperatures; that is, consecutive days of similar sea-surface temperatures have been placed in one group. The mean positions, number of days, and dates included by these groups are presented in table 1, and the eighteen areas defined by the periods have been plotted in figure 3. Three groups (numbers VII, XIII, and XVII) have been subdivided into seven subgroups (VIIa, VIIb, XIIIa, XIIIb, XVIIa, XVIIb, and XVIIc) owing to the fact that the Carnegie spent two or three periods in each of these areas.

Acknowledgments

A complete enumeration of all those who generously offered advice and assistance in carrying out the meteorological program of the Carnegie, and who aided in bringing this work to its final published form, would hardly be possible. No report of the meteorological work of the Carnegie, however, should fail to mention Dr. J. H. Paul, the observer-in-charge of the meteorological program of cruise VII of the Carnegie, for his painstaking care in obtaining and recording data; Dr. H. U. Sverdrup, who began the compilation of data, for his constant assistance throughout all stages of the work; Dr. C. F. Brooks, for his many helpful suggestions; Dr. J. Bartels, of Germany, who, during a year as research associate with the Department of Terrestrial Magnetism, also gave advice and directions concerning the interpretation of results, particularly with reference to the chapter on atmospheric pressure; and finally, Dr. J. A. Fleming, Director of the Department. Appreciation is also due the staff members of the Department of Terrestrial Magnetism and the faculty of the University of California, Scripps Institution of Oceanography, for their interest and assistance.

La Jolla, California
September 21, 1937

ATMOSPHERIC PRESSURE

INSTRUMENTS AND METHODS

Barometers

Throughout the entire cruise the Carnegie carried two barometers, one mercurial and one aneroid. A standard marine mercurial barometer of the Kew type (U. S. Weather Bureau No. 7272) was mounted in the chart room of the vessel, 3.96 meters from the port rail, 6.25 meters from the starboard rail, and 1.98 meters above load water line. A scale error of -0.409 mm was determined by the Instrument Division of the U. S. Weather Bureau in April 1928. The corrections for temperature and gravity were made according to the formula

$$\left[-0.0001634 / (1 + 0.0001818t)\right] \; 760t + a$$

where t is the reading of the attached thermometer and a is a variable correction for gravity dependent on latitude. Whereas the mercury readings were corrected on board for temperature, height above the sea (+0.20 mm), standard gravity, scale errors, and capillarity, there is no record of control observations between this instrument and mercurial barometers at the ports visited. It was impossible to determine whether any change in the correction constants had occurred during the cruise by obtaining a series of control observations at a later date, inasmuch as most of the instrumental equipment, including the barometer, was destroyed when the vessel burned at Apia, Western Samoa.

Mercurial barometer observations were made daily at noon GMT, and the height of the mercury column was read to the nearest 0.1 mm. Each observation usually consisted of twenty distinct readings, the mean of the twenty being taken as the final value. On days when considerable "pumping" of the mercury was evident, however, as many as forty readings were taken, and every effort was made to obtain an equal number of readings at the bottom and top of the "pumping range." The attached thermometer was read at the beginning and end of each series of mercury readings, and the mean of the two was used for obtaining the correction for temperature effect.

A Paulin type aneroid barometer (no number) was suspended in the chart room approximately 3.4 meters above load water line and was used by the various observers in atmospheric electricity, pilot-balloon work, and navigation. This instrument was compared daily at noon GMT with the standard mercurial barometer. The differences between the two instruments seldom exceeded 0.5 mm, but when the air temperature fell much below 10°, the sensitivity of the aneroid was considerably decreased, apparently because of the thickening of the castor-oil lubricant. No doubt this difficulty would have been eliminated if the instrument had been thoroughly cleaned by immersion in benzine and all traces of oil removed from moving parts. This barometer, however, was not used for routine pressure observations, and consequently these errors are of little significance.

Barograph

The barograph, a sylphon-vacuum-chamber type with seven-day clock movement constructed by Julian P. Friez and Sons, of Baltimore, was mounted on a shelf in the cabin approximately amidships and 1.07 meters above load water line. The barograms were graduated to read from 715 mm to 795 mm, and the time scale was changed in such a manner that the values of pressure could be read at every full hour, local mean time. The corrections to be applied to the hourly readings of the barograph were computed from the corrected standard mercurial readings at noon, and the differences between barograph and corrected barometer readings at this hour each day were plotted directly on the barograms and curves drawn through these points. If the pressure changes during the week were irregular, an average correction for the week was computed and applied as a correction to the hourly values for that week, but if the curve of differences showed a regular change, owing either to a buckling of the paper or to a shift in position on the drum, the correction to be applied to each hourly value was obtained directly from the plotted curve of differences.

DISCUSSION

Departures from Normal Regional Values of Pressure

The mean daily values of atmospheric pressure as determined on the cruise of the Carnegie can be expected to have little climatological significance, inasmuch as the time spent in any region with more or less homogeneous climate was short. Therefore, we are hardly justified in assuming such day-to-day observations made on board a rapidly moving vessel to be truly representative of pressures within a fixed region, no matter how large this region may be. It has been possible, however, to determine the departure of Carnegie pressures from monthly normals which have been computed from pressure data previously accumulated over the North Atlantic Ocean and the North and South Pacific oceans.

Continuous observation of air pressure was obtained for a period of 344 days during the cruise. The corrected hourly values of barometric pressure arranged chronologically are presented in appendix III (table 77); the position of the vessel at local noon is entered at the left of the table. From these values it has been possible to determine departures of pressure from predetermined values of normal pressure for the various regions, by months, as given by Bartholomew's Physical Atlas, British Admiralty charts, Pilot Charts of the U. S. Hydrographic Office, Hoffmeyer charts, publications of the Japanese Imperial Marine Observatory, and the Deutsche Seewarte charts. These sources usually gave very nearly the same normal values for the various regions, but where there was disagreement the most recent, and presumably most accurate, source was chosen. The normal values of atmospheric pressure for the Atlantic Ocean have been determined from the monthly means of many more observations than have the monthly normals for the Pacific Ocean. The Atlantic normals, therefore, should more nearly approach the true normals for the region.

Table 2 contains data concerning the differences between the Carnegie mean pressures and the normal mean pressures for the twenty-two groups outlined in table 1. From these data the following general conclusions may be drawn:

1. Pressures were slightly above normal during the first part of the cruise from Hamburg to Iceland, and until the Gulf Stream was crossed.

2. Pressures were slightly below normal for the part of the cruise between the Gulf Stream and Barbados.

3. Pressures averaged about normal over the Caribbean Sea and the South Pacific Ocean until the South Pacific High-Pressure Belt was reached, although for eight days during December 1928, when the vessel was very nearly in the center of the South Pacific High-Pressure System, the barometer averaged 5 mm higher than the normal for that region.

4. Throughout the western part of the cruise in the Pacific, which lay largely in the equatorial and trade-wind belts, the observed pressures were near normal for those belts.

5. During June and July 1929, between latitudes 35° and 52° north and longitudes 141° east and 150° west, the mean values of atmospheric pressure averaged from 2 to 6 mm higher than the ten-year mean for this region as given by the tables of the Japanese Marine Observatory [see 1 of section of references, p. 61]. This condition indicated a greater northwesterly extension of the North Pacific High-Pressure Belt during these months.

6. Pressures on the outward cruise from San Francisco to Apia averaged slightly below normal, which would indicate that the condition mentioned in the previous paragraph continued throughout this period.

Table 2. Comparison of Carnegie and normal values of atmospheric pressure for groups, Carnegie, 1928-29

Group	Months	No. days	Mean		Carnegie (mean)	Normal	Difference
			Latitude	Longitude			
			°	°	mm	mm	mm
I	July-Aug.	9	56.3 N	40.7 W	762	759	+3
II	August	4	42.8 N	47.8 W	766	764	+2
III	August	13	29.0 N	42.0 W	763	765	-2
IV	Aug.-Sep.	21	11.8 N	43.0 W	760	762	-2
V	October	9	13.8 N	71.0 W	759	759	0
VI	Oct.-Nov.	12	4.0 N	81.0 W	758	759	-1
VII							
(a)	Nov.-Dec.	35	16.5 S	104.3 W	763	762	+1
(b)	February	7	13.1 S	119.4 W	759	759	0
VIII	December	8	37.2 S	96.7 W	770	765	+5
IX	January	14	24.7 S	83.3 W	763	763	0
X	February	12	12.3 S	88.2 W	760	760	0
XI	March	21	16.8 S	147.9 W	759	759	0
XII	April-May	32	9.7 N	168.7 E	759	759	0
XIII							
(a)	June	13	34.3 N	143.1 E	760	758	+2
(b)	July	3	39.6 N	149.4 E	765	759	+6
XIV	July	19	47.7 N	179.5 W	763	760	+3
XV	July	7	41.5 N	131.8 W	764	764	0
XVI	September	5	34.1 N	126.3 W	761	763	-2
XVII							
(a)	September	8	27.8 N	136.6 W	762	764	-2
(b)	Sep.-Oct.	8	27.0 N	155.1 W	765	765	0
(c)	October	14	25.2 N	140.7 W	760	763	-2
XVIII	Oct.-Nov.	20	0.1 S	150.5 W	757	758	-1

Maxima and Minima of Pressure

The absolute maximum pressure during the cruise (773.7 mm) was recorded at 21h, December 26, 1928, at latitude 40° south in longitude 97° west, near the center of the South Pacific High-Pressure Belt. The absolute minimum pressure (744.9 mm) occurred between 11h and 12h on June 6, 1929, at latitude 35° north in longitude 141° east, while the Carnegie was hove to on the southern edge of a typhoon.

The highest daily mean pressure also occurred on December 26, 1928, the same day on which the absolute maximum pressure was recorded. The lowest daily mean pressure occurred on June 7, 1928, at latitude 50° north in longitude 8° west. Between 21h and 22h on this date the pressure (746.2 mm) averaged only 1.3 mm higher than the absolute minimum pressure recorded on June 6, 1929. On this date, however, the rate of fall was only 4 mm in twenty-four hours, whereas at the time of the typhoon, the barometer fell 12 mm during 11h on June 5 to 11h on June 6, 1929. Another very rapid pressure fall was recorded on May 22 and 23, 1928, while the Carnegie was crossing the North Atlantic. During this period the barometer fell from 764.9 mm at 23h on May 22, to 753.0 mm at 23h on May 23, a fall of 11.9 mm. On this occasion the wind blew from the northeast with gale force, indicating that the Carnegie at the time was on the northern periphery of an unusually well-developed extratropical cyclone (see appendix III, table 77).

Data concerning the greatest mean maximum pressures for the several ranges of latitude are presented in table 4. This table shows that the greatest mean pressures occurred in the two subtropical high-pressure regions; the greatest daily maximum pressure occurred in the range of latitude 35° to 45° south (771.9 mm), and the next highest mean pressure occurred between latitudes 35° and 45° north. The lowest mean daily minimum pressure occurred in the range of latitude 55° to 65° north.

Table 3. Mean atmospheric pressure for latitude ranges, Carnegie, 1928-29

Latitude range	No. days	Mean pressure
° °		mm
55-65 N	17	758.50
45-55 N	38	760.01
35-45 N	32	762.99
25-35 N	38	761.44
15-25 N	32	760.85
5-15 N	43	759.10
5 N-5 S	29	758.66
5-15 S	45	758.47
15-25 S	33	760.44
25-35 S	22	765.54
35-45 S	9	771.08
Total days	338	.....
Mean all latitudes		761.55
Mean all days		760.72

Daily Amplitudes of Atmospheric Pressure

The data on atmospheric pressure have been collected and summarized for each ten-degree range of latitude beginning with latitudes 65° north and 45° south. These values may be taken as representative of the conditions for the approximate latitudes 0°, 10°, 20°, 30°, 40°, 50°, and 60° north and 10°, 20°, 30°, and 40° south (the mid-points of the latitude ranges). The mean hourly values of pressure within each of the ranges of latitude have been corrected for noncyclic change determined from the difference between the mean values of pressure at 00h and at 24h. The correction has been applied linearly to the mean values for each of the twenty-four hours, one-half of the difference being applied at 00h and at 24h. The results of these computations are presented tabularly in table 5 and graphically in figure 4.

The last two lines of table 5 give respectively the average departure and the amplitude (difference between highest and lowest mean departure).

The unperiodic daily amplitude measured by the difference between the mean daily extremes is seen to be greatest between latitudes 45° and 65° north (table 6). It is to be noted that this is in direct contrast with the periodic daily amplitude measured by the difference between the highest and lowest hourly means, which is smallest in these latitudes. This can be explained by a consideration of the frequency of certain ranges of amplitude according to latitude (table 6). The greater frequency of days with amplitudes less than 4 mm south of latitude 30° north, and the greater scattering of the ranges north of this latitude, account for this increase in unperiodic amplitude with increasing latitude.

Table. 4. Mean and extreme values of atmospheric pressure for latitude ranges, Carnegie, 1928-29

Value	Latitude range										
	65°N-55°N	55°N-45°N	45°N-35°N	35°N-25°N	25°N-15°N	15°N-5°N	5°N-5°S	5°S-15°S	15°S-25°S	25°S-35°S	35°S-45°S
Mean	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
Daily	758.5	760.1	762.4	761.5	760.8	759.1	758.7	758.5	760.4	765.6	771.1
Maximum	760.2	761.9	763.5	762.8	761.8	760.2	760.0	759.6	761.5	766.4	771.9
Minimum	756.7	758.4	761.5	760.1	759.8	757.9	757.3	757.2	759.4	764.7	770.2
Amplitude	3.5	3.5	2.0	2.7	2.0	2.3	2.7	2.4	2.1	1.7	1.7
Absolute											
Maximum	767.4	770.1	769.9	769.6	764.8	762.4	763.0	763.7	766.6	769.2	773.7[a]
Minimum	747.7	746.2	751.3	744.9[b]	757.7	753.7	753.8	753.9	755.6	759.8	766.2
Amplitude	19.7	23.9	18.6	24.7	7.1	8.7	9.2	9.8	11.0	9.4	7.5

[a] Absolute maximum of cruise, Dec. 26, 1928, at 21h in latitude 40° south, longitude 97° west.

[b] Absolute minimum of cruise, June 6, 1929, at 11h and 12h in latitude 35° north, longitude 140° east, on southern edge of a typhoon.

Table 5. Diurnal variation of atmospheric pressure for latitude ranges, Carnegie, 1928-29

LMT	Latitude range, number of days of record, and months involved					
	65°N-55°N 17 days, July-Aug.	55°N-45°N 40 days, May-Aug.	45°N-35°N, 35 days, May-Sep.	35°N-25°N 38 days, May-June Aug.-Oct.	25°N-15°N, 32 days, May and Aug.-Oct.	15°N-5°N 44 days, May and Aug.-Nov.
h	mm	mm	mm	mm	mm	mm
0	+0.03	+0.04	+0.04	+0.24	+0.42	+0.31
1	-0.07	0.00	-0.05	+0.23	+0.12	-0.06
2	-0.22	-0.08	-0.18	+0.01	-0.13	-0.44
3	-0.32	-0.09	-0.31	-0.15	-0.26	-0.60
4	-0.35[a]	-0.10	-0.32[a]	-0.15	-0.31	-0.54
5	-0.25	0.00	-0.24	-0.12	-0.15	-0.38
6	-0.14	+0.09	-0.13	+0.03	+0.04	-0.06
7	-0.06	+0.17[a]	-0.02	+0.19	+0.33	+0.30
8	+0.08	+0.16	+0.07	+0.39	+0.53	+0.66
9	+0.18	+0.11	+0.24	+0.49[a]	+0.61	+0.86
10	+0.23	+0.14	+0.32[a]	+0.49[a]	+0.66[a]	+0.81
11	+0.30[a]	+0.17[a]	+0.23	+0.36	+0.47	+0.64
12	+0.28	+0.12	+0.17	+0.14	+0.13	+0.21
13	+0.14	-0.01	+0.12	-0.17	-0.31	-0.25
14	+0.08	-0.11	+0.06	-0.42	-0.67	-0.64
15	-0.11	-0.09	+0.11	-0.55	-0.85	-0.64
16	-0.21	-0.19	-0.11	-0.64[a]	-0.90[a]	-0.90[a]
17	-0.11	-0.20[a]	-0.21	-0.63	-0.82	-0.73
18	-0.04	-0.19	-0.15	-0.53	-0.59	-0.41
19	+0.04	-0.20[a]	-0.11	-0.27	-0.24	-0.09
20	+0.06	-0.05	+0.05	-0.01	+0.14	+0.28
21	+0.14	+0.08	+0.17	+0.29	+0.47	+0.58
22	+0.18	+0.07	+0.16	+0.40	+0.63	+0.69
23	+0.19	+0.14	+0.11	+0.32	+0.60	+0.60
Mean pressure	758.49	760.10	762.37	761.46	760.85	759.07
Average departure	0.16	0.11	0.15	0.30	0.43	0.50
Amplitude	0.65	0.37	0.64	1.13	1.56	1.76

LMT	Latitude range, number of days of record, and months involved					
	5°N-5°S, 29 days, Apr.-May Oct.-Nov.	5°S-15°S, 45 days, Nov. and Jan.-Apr.	15°S-25°S, 33 days, Nov. and Jan.-Mar.	25°S-35°S, 22 days, Nov.-Jan.	35°S-45°S, 9 days, Dec.	
h	mm	mm	mm	mm	mm	
0	+0.27	+0.39	+0.32	+0.17	+0.13	
1	-0.11	-0.04	-0.11	-0.07	-0.08	
2	-0.44	-0.38	-0.48	-0.33	-0.28	
3	-0.56	-0.54	-0.66	-0.54	-0.36[a]	
4	-0.49	-0.51	-0.64	-0.49	-0.32	
5	-0.27	-0.31	-0.44	-0.26	-0.27	
6	+0.14	0.00	-0.12	+0.02	-0.15	
7	+0.61	+0.46	+0.31	+0.31	+0.06	
8	+1.09	+0.85	+0.71	+0.38	+0.20	
9	+1.24[a]	+1.01[a]	+0.83[a]	+0.40	+0.21	
10	+1.15	+0.98	+0.75	+0.38	+0.20	
11	+0.81	+0.74	+0.59	+0.35	+0.31[a]	
12	+0.28	+0.36	+0.18	+0.23	+0.29	
13	-0.28	-0.11	-0.22	+0.04	+0.18	
14	-0.28	-0.57	-0.53	-0.16	+0.06	
15	-1.19	-0.90	-0.76	-0.40	-0.05	
16	-1.25[a]	-1.07[a]	-0.82[a]	-0.57[a]	-0.14	
17	-1.08	-1.01	-0.72	-0.55	-0.28	
18	-0.70	-0.75	-0.43	-0.44	-0.31	
19	-0.28	-0.37	-0.08	-0.16	-0.18	
20	+0.20	+0.06	+0.33	+0.09	+0.05	
21	+0.54	+0.41	+0.59	+0.34	+0.23	
22	+0.64	+0.63	+0.71	+0.45[a]	+0.27	
23	+0.58	+0.64	+0.59	+0.33	+0.20	
Mean pressure	758.66	758.47	760.45	765.56	771.09	
Average departure	0.63	0.54	0.50	0.30	0.20	
Amplitude	2.49	2.08	1.65	1.02	0.67	

[a] Extreme mean values.

Table 6. Unperiodic amplitudes of atmospheric pressure classified according to number of days and latitude range, Carnegie, 1928-29

Unperiodic daily amplitude	Latitude range										
	65°N-55°N	55°N-45°N	45°N-35°N	35°N-25°N	25°N-15°N	15°N-5°N	5°N-5°S	5°S-15°S	15°S-25°S	25°S-35°S	35°S-45°S
mm											
0- 2	7	17	28	27	29	28	11	31	29	20	7
2- 4	3	13	5	5	3	16	18	14	4	2	2
4- 6	6	5	2	3	...	...	...	...	...	...	..
6- 8	1	3	...	1	...	...	...	...	...	...	..
8-10	..	1	...	2	...	...	...	...	...	...	..
10-12	..	1	...	...	...	...	...	...	...	...	..
Total	17	40	35	38	32	44	29	45	33	22	9

Table 7. Unperiodic daily amplitude of pressure, Gauss, 1901-03

Latitude	Amplitude	Latitude	Amplitude
°	mm	°	mm
50 N	0.73	0	1.99
40 N	0.83	10 S	2.01
30 N	1.08	20 S	1.50
20 N	1.74	30 S	1.11
10 N	1.86	40 S	0.94

The periodic daily amplitude of pressure measured by the difference between the highest and lowest mean hourly values is, as shown in table 5, clearly dependent on latitude. This fact may be emphasized by comparing the values given in the bottom line of table 5 with the values of the periodic daily amplitude observed on the Gauss [2] in the Atlantic Ocean. The only exception to this decrease in amplitude with increase in latitude occurred within the range of latitude 45° to 55° north, in which the small diurnal range of 0.37 mm was recorded. This unusually small value, which will appear conspicuously in the amplitude of the 12-hour pressure wave, is probably related directly to the small diurnal range of temperature in these latitudes.

Diurnal Pressure Oscillations [a]

General Discussion

Table 5 gives the hourly values of the diurnal inequalities of pressure for the various latitude ranges. For each range in latitude the departures have been subjected to Fourier analysis and the result has been expressed in one of the following forms:

$$(a_1 \cos t + b_1 \sin t) + (a_2 \cos 2t + b_2 \sin 2t) + (a_3 \cos 3t - b_3 \sin 3t) + (a_4 \cos 4t + b_4 \sin 4t) = c_1 \sin (t + \phi_1) + c_2 \sin (2t + \phi_2) + c_3 \sin (3t + \phi_3) + c_4 \sin (4t + \phi_4) \quad (1)$$

where a and b are the Fourier coefficients, c the amplitude of the oscillation, t the time from local midnight expressed in degrees, and ϕ the time, also expressed in degrees, which fixes the phase of the oscillation in local time. The Fourier quantities so obtained for the various ranges of latitude represent the amplitudes and phase angles of the pressure waves (table 8).

The 24-hour Period

The 24-hour wave, represented by c_1 and ϕ_1 in (1), appears to be chiefly dependent on temperature. Therefore, as would be expected, the amplitudes and phase angles as computed from the Carnegie data are very irregular, because of changes in season, variation in meteorological conditions, and differences in location with respect to land and water bodies. With regard to the amplitudes it is sufficient to state that the Carnegie data show that such values are greatest near the equator (0.453 mm), and decrease toward the poles as the periodic waves become masked by the pressure waves accompanying cyclonic and frontal movements. The phase angles are fairly regular throughout the ranges of latitude between 15° north and 25° south, the maximum pressure occurring between 05h 32m and 06h 24m (7° to 354°), local mean time. From similar pressure observations over the ocean, Hann [3] and Meinardus [4] found that the phase angle (ϕ_1) crossed into the third quadrant (180° to 270°) at about latitude 30° north. According to the Carnegie data, however, this transition appears to occur between latitudes 35° and 45° north (table 8).

The 12-hour Period

The 12-hour pressure oscillation appears to have been given more attention by investigators than have the 24-, 8-, and 6-hour periods. Because this wave is less dependent on local temperatures than the 24-hour wave, it tends toward greater regularity with regard both to amplitude and to phase angle. Simpson [5] has shown that this double diurnal oscillation of the barometer can be regarded as consisting of two vibrations: one the result of waves traveling around the earth from east to west, and the other of an oscillation between the poles and equator. According to Simpson [5], the first (parallel to the circles of latitude) may be represented by the expression

$$C_2 = 0.937 \cos^3\phi \sin (2x - 154°) \quad (2)$$

and the other (parallel to the meridians) by

$$C'_2 = 0.137 (\sin^2\phi - 1/3) \sin (2x - 105° - 2\lambda) \quad (3)$$

A small seasonal variation exists, with maxima at the equinoxes and minima at the solstices [5, 6, 7].

[a] Much of the material in this section has appeared in Beitr. Geophysik, vol. 39, pp. 337-355 (1933).

Table 8. Results of Fourier analysis (harmonic coefficients) of diurnal waves of atmospheric pressure for latitude ranges, Carnegie, 1928-29

Designation	Latitude range and number of days of record					
	65°N-55°N, 17 days	55°N-45°N, 30 days	45°N-35°N, 35 days	35°N-25°N, 38 days	25°N-15°N, 32 days	15°N-5°N, 44 days
	Coefficients in mm					
a_1	−0.094	−0.022	−0.104	+0.079	+0.142	+0.022
a_2	+0.138	+0.068	+0.140	+0.224	+0.262	+0.253
a_3	−0.009	+0.014	+0.027	+0.007	+0.009	+0.024
a_4	+0.034	+0.014	−0.032	−0.023	+0.006	+0.009
b_1	-0.059	+0.098	-0.032	+0.256	+0.295	+0.191
b_2	-0.184	-0.109	-0.158	-0.355	-0.567	−0.718
b_3	-0.014	-0.044	-0.035	+0.001	-0.019	-0.002
b_4	+0.005	-0.011	0.000	-0.006	-0.030	−0.031
	Amplitudes in mm					
c_1	0.111	0.100	0.109	0.267	0.328	0.192
c_2	0,230	0.129	0.212	0.420	0.625	0.761
c_3	0.017	0.046	0.045	0.007	0.021	0.024
c_4	0.034	0.018	0.032	0.024	0.030	0.032
	Phase angles in °					
$\phi 1$	238.0	347.5	252.8	17.1	25.7	6.6
$\phi 2$	143.3	147.9	138.5	147.8	155.2	160.6
$\phi 3$	213.0	162.6	142.6	83.8	153.4	94.6
$\phi 4$	81.6	128.0	270.0	256.8	168.0	164.2

Designation	Latitude range and number of days of record					
	5°N-5°S, 29 days	5°S-15°S, 45 days	15°S-25°S, 33 days	25°S-35°S, 22 days	35°S-45°S, 9 days	15°N-15°S, 118 days
	Coefficients in mm					
a_1	-0.022	-0.038	+0.002	-0.085	-0.098	-0.013[a]
a_2	+0.277	+0.358	+0.252	+0.239	+0.185	+0.296[a]
a_3	+0.015	+0.042	+0.050	-0.010	+0.023	+0.027[a]
a_4	-0.005	+0.002	-0.009	+0.062	-0.010	+0.002[a]
b_1	+0.452	+0.366	+0.146	+0.110	-0.008	+0.336[a]
b_2	-0.882	-0.725	-0.716	-0.415	-0.207	-0.775[a]
b_3	+0.011	-0.041	-0.031	-0.113	-0.090	-0.011[a]
b_4	-0.013	-0.014	-0.006	+0.033	+0.003	-0.019[a]
	Amplitudes in mm					
c_1	0.453	0.368	0.146	0.138	0.099	0.336
c_2	0.924	0.809	0.759	0.479	0.278	0.829
c_3	0.019	0.059	0.059	0.114	0.093	0.029
c_4	0.014	0.014	0.011	0.071	0.010	0.019
	Phase angles in °					
$\phi 1$	357.2	354.1	0.9	322.3	265.1	357.8
$\phi 2$	162.6	153.7	160.6	150.0	138.2	159.1
$\phi 3$	54.3	134.6	122.3	185.2	165.7	112.2
$\phi 4$	201.0	171.3	233.6	62.0	285.6	174.0

[a] Means of values for ranges 15° N-5° N, 5° N-5° S, and 5° S-15° S, from which c and ϕ were determined.

The harmonic dial, which has been described by Bartels [8], illustrated in figures 6-10, 21, is a convenient device for diagrammatically representing these harmonic coefficients. One hour is represented on the circumference of the circle by 15°, 30°, 45°, and 60° for the 24-hour, 12-hour, 8-hour, and 6-hour waves respectively. It is thus possible to show the phase angles and amplitudes of the several waves on a single diagram. A circle whose radius represents the probable error of the computations has been drawn around each point so plotted; the value of the radius has been determined by interpolation between values of standard deviation for a single day. This method has been developed by Bartels [9] for pressure data for Potsdam and Batavia.

The primary values were (0.16 mm/$\sqrt{N}$) for latitudes 15° north to 15° south, (0.20 mm/$\sqrt{N}$) for ±20°, (0.24 mm/$\sqrt{N}$) for ±30°, and (0.28 mm/$\sqrt{N}$) for ±40°. The numerator represents the interpolated standard deviation for a single day, and the denominator the square root of the number of days (N) of observation. The probable error, p_2, implies that there are as many deviations greater as there are smaller.

For comparison, the data of the Carnegie and Gauss [2] are plotted together on a single harmonic dial which is in figure 6. The phase angles in this figure appear very regular; the mean for latitudes 35° north to 35° south falls within a range of 12° 08′ (25.6 minutes of time). Except within the ranges of latitude 15° north to 15° south and 15° to 25° south, the values of the Gauss for the amplitudes of these pressure oscillations are greater than similar values computed from the data of the Carnegie. This result is not of great significance,

Table 9. Comparison of 12-hour waves of atmospheric pressure observed on Carnegie, 1928-29, and on Gauss, 1901-03

(Values computed from mean of all data within the indicated latitude range)

Latitude range	Carnegie			Gauss		
	Phase angle	Amplitude	Prob. error	Phase angle	Amplitude	Prob. error
° °	°	mm	mm	°	mm	mm
55 N-45 N	147.9	0.129	0.047	.....	.....	.....
45 N-35 N	138.5	0.212	0.047	155.6	0.329	0.075
35 N-25 N	147.8	0.420	0.039	156.0	0.511	0.058
25 N-15 N	155.2	0.625	0.035	154.9	0.708	0.050
15 N-15 S	159.1	0.829	0.015	154.6	0.818	0.021
15 S -25 S	160.6	0.759	0.036	155.6	0.701	0.052
25 S -35 S	150.0	0.479	0.051	160.5	0.496	0.038
35 S -45 S	138.2	0.278	0.093	.....	.....	.....

Table 10. Comparison of 12-hour waves of atmospheric pressure from observations at sea and as computed by Simpson

Mean latitudes	Carnegie			After Hann[b]			Computed[c]	
	Phase angle	Amplitude	Prob. error	Phase angle	Amplitude	Prob. error	Phase angle	Amplitude
	°	mm	mm	°	mm	mm	°	mm
15 N and 15 S[a]	159.1	0.829	0.015	156.3	0.852	0.011	154	0.924
20 N and 20 S[a]	158.2	0.692	0.020	153.1	0.662	0.016	154	0.770
30 N and 30 S[a]	148.9	0.450	0.026	150.3	0.501	0.023	154	0.609
40 N and 40 S[a]	138.3	0.244	0.036	158.1	0.338	0.012	154	0.422

[a] Values determined from means of all data obtained within 5° north or south of indicated latitudes. [b] From observations on the vessels Novara, Saida, Donau, and Challenger. [c] After Simpson.

however, for the two sets of observations are not comparable with respect to either season or longitude.

A similar comparison has been made of the 12-hour wave as computed from the Carnegie data, and as computed from data averaged for various mean latitudes by Hann [10] from observations made on the Challenger, Novara, Saida, and Donau (table 10). In order to obtain means for latitudes comparable with the ranges of latitude selected for assembling the data of the Carnegie, Hann's values have been averaged for each 10° of latitude by taking the mean Fourier coefficients, a_2 and b_2, and computing new values of ϕ_2 and C_2. The number of observations is large; therefore radii of the probable-error circles are small. Simpson's values, on the other hand, were obtained by assuming the required latitudes for the equatorial part of the 12-hour vibration (equation 2), and it was thus impossible to construct probable-error circles for his data.

Figure 7 emphasizes the fact that the amplitude of the semidiurnal pressure wave is smaller over the oceans than over land areas. Simpson's formula was constructed chiefly from pressure observations at land stations. At latitude 40° north, the amplitude obtained from Hann's values is 80 per cent of that computed from Simpson's formula. At this latitude the Carnegie values for the amplitude of the pressure wave indicate only 58 per cent of the computed value. The amplitudes at other latitudes average around 85 per cent of Simpson's values.

The harmonic dials given in figures 6 and 7 show clearly that the amplitude of the 12-hour wave decreases with increasing latitude. Various investigators, notably Hann [11], Schmidt [6], Margules [12], Jaerisch [13], and Meinardus [4, p. 454], have attempted to evolve a mathematical formula which would express this rate of decrease in amplitude with latitude. The general form for all the suggested formulas has been to place c_c equal to a constant multiplied by some power of the cosine of latitude. The constants were usually computed from pressure data obtained all over the world, irrespective of land or ocean position, and tended to be heavily overweighted by data from land observatories. All these previously determined formulas, except that of Meinardus, obtained from observations on the Gauss, and that of Margules (who assigns no value to the constant factor), give amplitudes much too large for purely oceanic areas. Moreover, none of these earlier formulas assume the amplitude to be a function of longitude or season. Simpson [5, p. 12], in 1918, by combining his equations for the equatorial and polar vibrations (equations 2 and 3), developed the following formula which sets forth C_2 as a function of longitude as well as of latitude, wherein λ is longitude east of Greenwich

$$C_2 = \Big[\Big\{0.937\cos^3\phi \sin 154^\circ + 0.137(\sin^2\phi - 1/3) \sin(105^\circ - 2\lambda)\Big\}^2 + \Big\{0.937\cos^3\phi \cos 154^\circ + 0.137(\sin^2\phi - 1/3)\cos(105^\circ - 2\lambda)\Big\}^2\Big]^{1/2} \quad (4)$$

In order to determine how closely values for the amplitude of the pressure wave, as computed from Simpson's formula, agree with the Carnegie values, the mean longitude and mean latitude positions corresponding to each of the Carnegie values for C_2 were computed. Only the Carnegie values from the Pacific Ocean west of longitude 180° and south of latitude 5° north have been used in these computations. As shown in table 11, the differ-

Table 11. Comparison of computed and observed amplitudes, c_2, of 12-hour waves of atmospheric pressure at sea

Item	Mean position				
	0°.6N 110°.3W	11°.7S 126°.7W	17°.9S 130°.2W	30°.6S 100°.2W	38°.5S 99°.3W
	mm	mm	mm	mm	mm
Computed[a]	0.982	0.915	0.837	0.606	0.405
Carnegie	0.924	0.809	0.759	0.479	0.278
Difference	0.058	0.106	0.078	0.127	0.127
P.E., Carnegie	0.030	0.024	0.035	0.051	0.093

[a] After Simpson

Table 12. Monthly distribution, number of days, atmospheric-pressure observations within each latitude range, Carnegie, 1928-29

Month	Latitude range										
	55°N-65°N	45°N-55°N	35°N-45°N	25°N-35°N	15°N-25°N	5°N-15°N	5°N-5°S	5°S-15°S	15°S-25°S	25°S-35°S	35°S-45°S
Jan.	...	...	...	...	...	...	...	2	4	8	...
Feb.	...	...	...	...	...	...	...	21	2	...	...
Mar.	...	...	...	...	...	...	...	2	22	...	...
Apr.	...	...	...	...	...	...	1	6	...	...	...
May	...	7	9	2	14	7	2	...	...	...	...
June	...	11	5	8	...	...	...	...	...	...	...
July	14	18	12	...	...	...	...	...	...	...	...
Aug.	3	4	7	5	5	7	...	...	...	...	...
Sep.	...	...	2	12	5	15	...	...	...	...	...
Oct.	...	...	...	11	8	13	4	...	...	...	...
Nov.	...	...	...	...	...	2	22	14	5	2	...
Dec.	...	...	...	...	...	...	...	...	...	12	9
Total	17	40	35	38	32	44	29	45	33	22	9

ences between Simpson's values and the Carnegie values, in three cases out of five, are greater than twice the probable errors of the latter. A comparison of the two sets of data indicates that the constants of Simpson's formula are too large for accurately representing conditions over the ocean. These differences, it is true, may in part be due to seasonal effects.

Simpson's values were intended to represent a yearly mean, whereas the Carnegie values translate a relatively few days of observation unsystematically distributed over a few months (table 12). For example, the Carnegie values at latitudes 30° 36′ south and 38° 30′ south are probably lower than the yearly mean value for these latitudes, since the Carnegie observations in this region were made during the southern summer months of December and January, when the amplitude of the 12-hour wave is at a minimum.

The small quantity of available pressure data from oceanic areas does not justify time spent in constructing a formula which would express the amplitude of the 12-hour wave at any season and position over the ocean. It is possible that these differences between the results of the Carnegie and those of Simpson may be partly regional in character, and therefore not representable by simple formulas. It seems probable, however, that Simpson's formula gives amplitudes several hundredths of a millimeter too high for oceanic areas.

Data from thirteen islands fairly well distributed with regard to latitude [14] have been compared with the Carnegie results at corresponding latitudes. The number of island stations suitable for this study was limited by the fact that data, in order to be comparable, had to fall within the same months as the observations made by the Carnegie. This comparison of the 12-hour wave at islands with the data from the Carnegie is presented in table 13 and is illustrated graphically in figure 8.

The 12-hour pressure waves at each of the island stations, except Lerwick, Mauritius, Mangarewa, and Samoa, show amplitudes greater than the mean amplitudes over the ocean at corresponding latitudes. There is reason to suspect that the amplitude computed from the Carnegie observations at the mean position, 20° south, is too large for this comparison, since it is greater than the amplitude at either Mauritius or Mangarewa, which are in about the same latitude. This is probably due to the unsymmetrical monthly distribution of the days included in the mean value for the Carnegie. The number of days recorded for November, February, and March was five, four, and twenty-two respectively. Since the amplitude of the 12-hour wave varies with the season and is greatest at the equinoxes, the mean may be heavily overweighted by days of fairly high amplitudes as compared with the mean for the islands where the monthly distribution of days is about the same. On the same basis, however, it is not possible to explain the large amplitude at latitude 60° north compared with the smaller amplitude at Lerwick. Of the seventeen days of observation on the Carnegie, fourteen were in July and three in August, a time when the amplitude is at a minimum in these latitudes. Moreover, with only one exception,

Table 13. Comparison of 12-hour waves of atmospheric pressure at approximately same latitudes on islands and at sea

(Carnegie values from mean of observations on all days when ship's position at local mean noon was within 5° north or 5° south of given latitude)

Station	Latitude	Period obs'ns.	Months	Phase angle	Difference	Amplitude	Difference
	°			°	°	mm	mm
Lerwick	60.1 N	2 years	May-Aug.	122		0.102	
Carnegie		17 days	July-Aug.	143.3	-21.3	0.230	-0.128
Jersey	49 N	10 years	May-Aug.	139.2		0.250	
Carnegie	50 N	40 days	May-Aug.	147.9	- 8.7	0.129	+0.121
Ponta Delgada	37.8 N	7 years	May-Sep.	148.1		0.384	
Carnegie	40 N	35 days	May-Sep.	138.5	+ 9.6	0.212	+0.172
Taiwan	25.0 N	10 years	May-June	161.6		0.633	
Carnegie	30 N	38 days	Aug.-Sep.	147.8	+13.8	0.420	+0.213
Port-au-Prince	18.5 N	6 years	May, Aug.-Oct.	161.3		0.778	
Guadeloupe	16.0 N	9 years	May, Aug.-Oct.	153.9		0.668	
Means	17.2 N			157.8		0.721	
Carnegie	20 N	32 days	May, Aug.-Oct.	155.2	+ 2.6	0.625	+0.096
Manila	14.6 N	12 years	May, Aug.-Nov.	161.2		0.895	
Jaluit	5.9 N	[a]	May, Aug.-Nov.	166.1		0.848	
Means	10.2 N			163.6		0.870	
Carnegie	10 N	44 days	May, Aug.-Nov.	160.6	+ 3.0	0.761	+0.109
Batavia	6 S	[a]	Nov., Jan.-Apr.	158.5		0.965	
Samoa	13.8 S	6 years	Nov., Jan.-Apr.	160.0		0.720	
Means	9.9 S	[a]		159.1		0.842	
Carnegie	10 S	45 days	Nov., Jan.-Apr.	153.7	+ 5.4	0.809	+0.033
Mangarewa	23.3 S	2 years	Nov., Jan.-Mar.	168.2		0.676	
Mauritius	20 S	[a]	Nov., Jan.-Mar.	162.3		0.722	
Means	21.6 S			165.1		0.698	
Carnegie	20 S	33 days	Nov., Jan.-Mar.	160.6	+ 4.5	0.759	-0.061
Easter Island	27 S	1 year	Nov.-Feb.	166.3		0.493	
Carnegie	30 S	22 days	Nov.-Jan.	150.0	+16.3	0.479	+0.014
Mean difference in amplitude (island-sea)							+0.063

[a] Not given in reference.

these seventeen days were cloudy to overcast, with frequent light mist, or otherwise affected by meteorological conditions which would lead one to expect a small amplitude [15]. In addition, the probable error of the seventeen observations of the Carnegie in latitude 60° north is estimated to be 0.073 mm, whereas the difference between the values for C_2 as computed from the data at Lerwick and those of the Carnegie is only 0.128 mm. For mean latitudes other than 20° south, the days in which observations were made by the Carnegie are more symmetrically distributed among the months used in the computations; therefore it can safely be assumed that the value of -0.06 mm, computed as the mean difference between island stations and oceanic locations, is probably near the true value.

Simpson [5, p. 12] maintains that the phase of the total semidiurnal wave at any position on the earth can be quite closely determined by

$$\tan A = \frac{0.937\cos^3\phi \sin 154° + 0.137(\sin^2\phi - 1/3)\sin(105° - 2\lambda)}{0.937\cos^3\phi \cos 154° + 0.137(\sin^2\phi - 1/3)\cos(105° - 2\lambda)} \quad (5)$$

As in equation (4), the righthand members of equation (5) contain as variables only the latitude ϕ, and the longitude λ. For the purposes of comparison, the mean longitudes corresponding to the Carnegie ranges of latitude were supplied in this formula and the phase angles for the mean positions computed. The computed and observed phases given in table 14 indicate no systematic difference between the observed phase angles and those calculated after Simpson's formula. Unfortunately, local mean time instead of apparent or ship's time was used in all computations for the Carnegie. According to the equation of time this error could not be greater than 8° in phase (16 minutes of time) and in most cases it would be considerably less than this.

In this connection it is interesting to compare the mean yearly phase angles of the 12-hour wave at Easter Island, Samoa, and Jaluit with those computed after Simpson's formula per equation (5) [14]. These results (table 15) indicate that in each case the observed phase angle is greater than the calculated; for example, the maximum amplitude occurs earlier than is indicated by Simpson's results. When the mean yearly phase angles for the island of Jersey (49° N, 2° W) and for Lerwick

Table 14. Phases of 12-hour waves of atmospheric pressure over South Pacific Ocean, Carnegie, 1928-29

Latitude		Longitude		No. days	Phase angle		
Mean	Range	Mean	Range		Observed	Computed	Difference[a]
°	°	°	°		°	°	°
0.6 N	9.8	110.3 W	96.6	29	162.6	153.6	+ 9.0
11.7 S	8.3	126.7 W	95.2	45	153.7	155.1	- 1.4
17.9 S	9.5	130.2 W	84.7	33	160.6	155.2	+ 5.4
30.6 S	9.5	100.2 W	33.1	22	150.0	153.6	- 3.6
38.5 S	5.1	99.3 W	12.4	9	138.2	154.5	-16.3

[a] Observed maximum amplitude occurs earlier than computed for positive difference, and later for negative difference.

Table 15. Comparison of mean yearly phase angles of 12-hour wave of atmospheric pressure for Easter Island, Samoa, and Jaluit with those computed from Simpson's formula

Place	Latitude	Longitude	ϕ_2		
			Carnegie (1)	Simpson (2)	$\Delta\phi_2$ (1) - (2)
	°	°	°	°	°
Easter Island	27 S	109 W	158.8	153.9	4.9
Samoa	14 S	172 W	160.0	156.4	3.6
Jaluit	6 N	170 E	165.6	155.4	10.2

(60° N, 1° W) are compared with those calculated for these locations, however, the observed phase angles (149.°4 and 138.°5, respectively) are smaller than those calculated.

Summarizing the discussion of the 12-hour wave of atmospheric pressure, the following general conclusions may be presented:

1. The amplitude of the 12-hour wave is less over the ocean than over land areas; the magnitude of the difference is of the order of 0.1 mm.

2. A comparison of the differences in amplitude at oceanic islands and for mean positions over the ocean indicates that the amplitude at island stations is of the order of 0.06 mm greater than at purely oceanic stations.

3. There appears to be a greater difference between the time of maximum amplitude of this wave between high and low latitudes over the ocean than is indicated by values computed after Simpson's formula.

The 8-hour Period

As shown in figure 9, the phase angles and amplitudes of the 8-hour wave also show remarkable regularity. The phase angle of this oscillation, for a given period of the year, is opposite in the Northern and Southern hemispheres, and changes phase for any given hour between winter and summer [15, p. 175]. The amplitude is greatest at latitude 30°. In summer the first minimum occurs at about 02h; in winter the first maximum occurs at this hour. Other maxima and minima follow at 8-hour intervals. The amplitude is smallest during the fall and spring months, and is always small at the equator.

It is rather difficult to analyze the Carnegie pressure data for this third harmonic, inasmuch as the cruise was so planned that the vessel was in each Hemisphere during the summer months, in order to avoid the stormier winter season. The Fourier coefficients of the 8-hour wave, however, have been determined and plotted in figure 9. The figure includes notations of the months during which the observations were made within each range of latitude. During the southern summer at latitude 30° south, the amplitude would be expected to be at a maximum; this is confirmed by the large amplitude (0.114 mm) shown on the harmonic dial for the mean position 30° south, during the months of November, December, and January. At the mean position latitude 30° north, observations were made during the months from May to October; the mean amplitude, therefore, is small (0.007 mm) since it is a resultant of waves of opposite seasons.

The preponderance of observations made during the summer season is apparent in figure 9. The crests of the first wave at all mean positions in the Southern Hemisphere and also at latitudes 20°, 40°, and 50° north occur between 05h 33m and 07h 17m (first minimum, therefore, around 02h), as would be expected during the summer season in either Hemisphere.

These results are in agreement with the conclusions drawn by Hann [16] and Sverdrup [17] from their careful analyses of the 8-hour pressure oscillation.

The 6-hour Period

The 6-hour pressure oscillation has been discussed thoroughly by S. K. Pramanik [18], who has compiled data from 136 stations well distributed with respect to season, latitude, and proximity to sea and land bodies. He concludes:

1. The mean annual amplitude, a_4, does not vary a great deal with latitude between ±50°, though it appears to have a maximum at about latitude 25°.

2. There is considerable seasonal variation in a_4, the winter greatly exceeding the summer values, more particularly at inland stations. The mean winter and summer values between ±59° latitude are respectively 0.051 mb and 0.011 mb at coast stations, and 0.059 mb and 0.009 mb at inland stations. The winter amplitude

Table 16. Comparison of mean phases of 6-hour waves of atmospheric pressure between latitudes 15° north and 15° south after Hann and Pramanik, and from Carnegie, 1928-29

Source	Mean angle (phase)	Remarks
	°	
Carnegie, all data	174.0	118 days, chiefly summer
Hann, oceanic data	139.6	430 days, all seasons
Pramanik, coastal stations	105.0	8 stations, summer
Pramanik, stations on land	294.4	4 stations, summer

has a maximum (about 0.061) at about 25° latitude and decreases to about 0.022 at 5° latitude, but decreases little up to about 50° latitude.

3. The annual mean phase A_4, is fairly constant from latitude 20° up to about 50°, its value being about 225° for coast and inland stations alike. The phase decreases toward the equator, being about 140° in 5° latitude.

4. The phase in summer is very irregular, in winter it is regular, being 200° or 210° from about 15° to 50° latitude, but decreasing somewhat toward the equator.

5. The phase appears to be considerably less over the oceans and oceanic islands than at land stations, though the amplitudes are of the same order.

6. There appears to be no regular dependence of amplitude and phase on altitude.

7. There are considerable variations of amplitude and phase at individual stations in any latitude, particularly in summer.

The results obtained by Sverdrup [17, p. 211] show a surprisingly close agreement with Pramanik's conclusions.

Considering the small amount of Carnegie data, and the preponderance of observations made during the summer months, it would be unreasonable to expect any great degree of regularity in the Fourier coefficients for the 6-hour wave (fig. 10). The distribution by quadrants of the eleven values of ϕ_4 illustrates this irregularity. They occur in the first, second, third, and fourth quadrants in the order 2, 4, 4, and 1, respectively. Pramanik found the distribution of ϕ_4 in these quadrants for thirty-one coastal stations during the summer months to be 8, 6, 11, and 6, respectively. Table 16 gives the results of a comparison of the Carnegie phase angle for a mean of data between latitudes ±50°, with some data from Pramanik [19] averaged for these latitudes where the seasonal effect should be small. There appears to be close agreement in phase between the Carnegie values and the coastal observations of Pramanik, but there is a marked difference between these values and the phase at his inland stations.

The mean amplitude of this wave for all the Carnegie Groups (as determined from the means of the values of a_4 and b_4 given in table 9) is 0.007 mm. This is very nearly the same value (0.008 mm) arrived at by Pramanik for his coastal stations in summer, and exactly the same amplitude that he obtained for the mean value in summer, for thirty-four inland stations. It is interesting to note that this apparent condition of an amplitude independent of ocean or land position, and of a phase angle smaller over sea than over land, is the reverse of that found for the 12-hour period. For the latter it appears that the phase angle is independent of land or ocean position, and that the amplitude is greater over land than over the sea.

CONCLUSION

In concluding the section on atmospheric pressure, it might be well to repeat that the amount of Carnegie data is relatively small and thus the probable errors of the computations must be relatively large. These results should, however, serve to change some previous concepts which have been derived through a similar use of inadequate data, and it is probable that further pressure observational work at sea will lead to some modifications of the views which have been presented here.

AIR TEMPERATURE

INSTRUMENTS AND METHODS

Thermometers

The only mercurial thermometer used for obtaining air temperatures during the cruise of the Carnegie was contained in the Assmann aspiration psychrometer. The dry-bulb tube (P.T.R. No. 2451-1928), mounted in the instrument screen, was a standard instrument and needed no corrections throughout the ranges of temperature encountered on the cruise. The Assmann psychrometer was read daily at noon (GMT), and the dry-bulb readings were used primarily for correcting the air-temperature records of the recording thermometers.

Meteorological Screen

The instrument screen was of the Stevenson type (fig. 11) and was mounted on the quarter-deck amidships, just forward of the wheel with the center of the screen 6.4 meters from the counter rail, 3.2 meters aft of the engine-room hatch, 3.7 meters from each side of the rail, and 3.7 meters above load water line.

Previous investigations have shown that the heating and cooling of a vessel's surface makes it very difficult to obtain accurate air-temperature readings within an ordinary thermometer screen on board. Lutgens [20] thus found errors up to 7° in the meteorological observations taken on board the Pangani, and Spinnangr [21], in studying the temperature measurements during a voyage on the S. S. Bergensfjord, found errors of 1° to 2°. Other investigators have reported similar results. These acknowledged errors have led Russeltvedt [22] to suggest that two or more screens mounted on opposite sides of the vessel are necessary for accurate air-temperature measurements.

No doubt the uncorrected air-temperature observations on board the Carnegie are highly erroneous owing to the fact that only one instrument screen was used and this was placed far from the rail. As will be explained, however, by using temperature measurements obtained at considerable heights above the deck and observing the diurnal variations between these and the deck observations, it has been possible to apply corrections to the deck temperatures and to obtain results which should be reasonably accurate.

Thermograph

The Negretti-Zambra capillary ventilating recording psychrometer, which will be discussed in greater detail in the chapter on humidity, was housed in the Stevenson screen and the recorded dry-bulb readings used in the temperature studies. This instrument was calibrated daily at noon against the Assmann psychrometer.

From time to time difficulty was experienced with the recording pens; the pen points had to be replaced at frequent intervals as the constant vibration of the apparatus soon wore them smooth. When the recording apparatus was first mounted in the Stevenson screen, the pens were adjusted to give true readings directly on the thermogram, but in regions of high humidity it was found that the wet- and dry-bulb pens would come into contact with one another. To obviate this difficulty the wet-bulb pen was later lowered one degree on the trace and an "offset" correction applied. In foggy or rainy weather the thermogram paper absorbed so much moisture that the traces became blurred.

The traces of the Negretti-Zambra instrument were scaled at each hour, local mean time, and corrected from the Assmann readings. These hourly temperature data appear in appendix III, table 78.

Hartmann and Braun Electrical-Resistance Thermographs

While the Carnegie was in Hamburg (June 22 to July 7, 1928) the firm of Hartmann and Braun installed three pairs of wet- and dry-bulb electrical-resistance thermometers at various heights above the deck (fig. 2). It was intended that these be used to record lapse rates from deck to crosstrees and masthead. The first pair of thermal elements was located in the Stevenson screen on the quarter-deck, 3.6 meters above sea level. The second pair was housed in a small naturally ventilated screen, 1.4 meters above the crosstrees on the mainmast and 21.9 meters above sea level. The third pair was attached near the main truck in a similar screen, 34.6 meters above load water line. From each of these thermal elements a single-strand, two-conductor cable led to the multiple recording apparatus in the control room on the quarter-deck.

The electrical recording apparatus had a separate pointer and distinctively colored ribbon for each thermometer. On the Carnegie, the pointers corresponding to the pairs of thermometers were "offset" on the record sheet so that the elements in the deck screen recorded 3° too high, those at the crosstrees 1°.5 too high, and those at the masthead according to the zero scale of the sheet. This procedure was followed in order to prevent the dots on the thermogram from becoming too confused for reading.

Some difficulty was experienced because of blotting and blurring of the trace when new ribbons were first installed. The clockwork of the apparatus was excellent, and it was seldom necessary to reset the thermogram to the proper time mark.

Corrosion and the constant working of the rigging caused frequent breaks in the cable running from the masthead and crosstrees. This was largely due to the fact that the cables were attached directly to the hemp rigging. Doubtless this difficulty would have been eliminated if suitable conduits had been used. Temporary repairs to the cable were not made at sea when these breaks occurred, because of the probability of changing the resistance in the electrical circuit from a constant to variable. In each case, as soon as suitable cable could be obtained, an entire new length was installed and the resistance again measured before the apparatus was put into operation.

These thermometers were calibrated from time to time against readings of the Assmann psychrometer; those in the Stevenson screen were compared daily.

It is evident that the value of the recorded temperatures depends on the efficiency of the ventilation of the screens, which in turn is a function of the wind speed and direction. Unfortunately, all wind records of the Carnegie were lost when the vessel was destroyed, and thus no

corrections to the recorded air temperatures based on such observations could be made. The Hartmann and Braun traces, therefore, could not be used for obtaining continuous records of lapse rates.

Evaluation of Thermograms

The corrections to the Negretti-Zambra and the Hartmann and Braun thermographs were found by means of the noon readings of the Assmann psychrometer. As soon as the air temperatures were obtained with the Assmann instrument, the pens were removed from the traces on the thermograms, and these readings entered directly on the sheet. The final corrections were used for constructing a curve which was entered directly on the thermogram, showing the correction as a function of time. From this curve the correction at any hour was read and applied to the reading of the thermograph at that hour.

Table 17. Mean hourly values of air temperature in degrees centigrade for groups, Carnegie, 1928-29

(Corrected for noncyclic change)

Group	Dates	No. days	Mean		Local mean hours		
			Latitude	Longitude	0	1	2
	1928		°	°	°	°	°
I	July 29-Aug. 6	9	56.3 N	40.7 W	9.67	9.66	9.60
II	Aug. 7-10	4	42.8 N	47.8 W	17.72	17.65	17.59
III	Aug. 11-23	13	29.0 N	42.0 W	25.89	25.83	25.84
IV	Aug. 24-Sep. 16[a]	21	11.8 N	43.0 W	26.57	26.50	26.46
V	Oct. 2-10	9	13.8 N	71.0 W	27.88	27.88	27.87
VI	Oct. 26-Nov. 6	12	4.0 N	81.0 W	25.17	25.06	24.99
VII							
(a)	Nov. 7-Dec. 21[b]	35	16.5 S	104.3 W	20.88	20.80	20.82
(b)	Feb. 22-28, 1929	7	13.1 S	119.4 W	25.76	25.69	25.61
VIII	Dec. 22-31[c]	8	37.2 S	96.7 W	17.04	16.93	16.86
	1929						
IX	Jan. 1-14	14	24.7 S	83.3 W	19.59	19.51	19.52
X	Feb. 6-17	12	12.3 S	88.2 W	23.47	23.31	23.36
XI	Mar. 1-31[d]	21	16.8 S	147.9 W	27.57	27.25	27.31
XII	Apr. 22-May 31[e]	32	9.7 N	168.7 E	26.51	26.49	26.57
XIII							
(a)	June 1-30[f]	13	34.3 N	143.1 E	20.68	20.50	20.37
(b)	July 1-3	3	39.6 N	149.4 E	15.58	15.36	15.40
XIV	July 4-21[g]	19	47.7 N	179.5 W	9.94	9.94	9.89
XV	July 22-28	7	41.5 N	131.8 W	14.35	14.37	14.13
XVI	Sep. 4-8	5	34.1 N	126.3 W	17.91	17.86	17.94
XVII							
(a)	Sep. 9-16	8	27.8 N	136.6 W	22.59	22.54	22.50
(b)	Sep. 17-Oct. 7[h]	8	27.0 N	155.1 W	24.43	24.53	24.71
(c)	Oct. 11-25[i]	14	25.2 N	140.7 W	22.73	22.62	22.48
XVIII	Oct. 26-Nov. 14	20	0.1 S	150.5 W	26.84	26.82	26.81

Group	Local mean hours										
	3	4	5	6	7	8	9	10	11	12	13
	°	°	°	°	°	°	°	°	°	°	°
I	9.55	9.59	9.50	9.50	9.59	9.64	9.91	10.41	10.55	10.69	10.73
II	17.54	17.44	17.44	17.13	17.19	17.26	17.66	17.91	18.15	18.43	18.37
III	25.82	25.83	25.81	25.75	25.78	26.03	26.16	26.62	26.93	27.22	27.31
IV	26.44	26.48	26.50	26.61	26.84	27.30	27.78	28.31	28.60	28.50	28.50
V	27.69	27.71	27.73	27.97	28.25	28.53	28.67	28.50	28.59	28.91	28.94
VI	25.09	25.10	25.08	24.95	25.06	25.23	25.29	25.41	25.42	25.72	25.84
VII											
(a)	20.82	20.76	20.80	20.97	21.21	21.44	21.69	21.92	22.01	22.10	22.13
(b)	25.61	25.64	25.67	25.65	25.81	26.24	26.38	26.43	26.61	26.76	26.96
VIII	16.89	16.92	16.98	17.13	17.18	17.58	17.77	17.73	17.98	18.08	18.21
IX	19.51	19.47	19.48	19.80	20.16	20.37	20.62	20.98	21.23	21.31	21.46
X	23.39	23.43	23.38	23.52	23.80	24.05	24.29	24.52	24.68	24.92	24.87
XI	27.36	27.33	27.25	27.22	27.63	28.07	28.38	28.58	28.69	28.84	28.91
XII	26.54	26.54	26.53	26.58	26.85	27.17	27.46	27.71	27.95	28.06	28.16
XIII											
(a)	20.23	20.05	19.95	20.12	20.19	20.35	20.62	20.68	21.13	21.18	21.08
(b)	15.11	15.06	15.10	15.17	15.45	15.60	16.24	16.34	16.33	16.07	16.04
XIV	9.75	9.67	9.64	9.61	9.54	9.49	9.55	9.65	9.85	10.00	10.15
XV	14.32	14.14	13.99	14.20	14.32	14.43	14.28	14.65	14.70	15.00	15.16
XVI	18.09	18.07	18.08	18.11	18.01	17.94	17.94	18.13	18.70	18.50	18.60
XVII											
(a)	22.20	22.39	22.37	22.41	22.58	22.78	22.95	23.12	23.33	23.49	23.59
(b)	24.68	24.66	24.63	24.57	24.91	25.41	25.72	25.96	26.10	26.26	26.11
(c)	22.48	22.61	22.61	22.62	22.71	22.89	23.01	23.16	23.10	23.12	22.94
XVIII	26.80	26.78	26.69	26.68	26.84	27.40	27.75	27.97	28.06	28.20	28.04

Table 17. Mean hourly values of air temperature in degrees centigrade for groups, Carnegie, 1928-29--Concluded

(Corrected for noncyclic change)

Group	Local mean hours										
	14	15	16	17	18	19	20	21	22	23	Mean
	°	°	°	°	°	°	°	°	°	°	°
I	10.70	10.70	10.77	10.60	10.55	10.24	10.03	9.93	9.87	9.72	10.06
II	18.39	18.54	18.59	18.51	18.62	18.21	17.88	17.71	17.88	17.90	17.90
III	27.27	27.24	27.21	26.95	26.61	26.25	26.10	25.99	26.07	25.95	26.33
IV	28.44	28.25	27.80	27.52	27.21	27.05	26.87	26.84	26.79	26.65	27.28
V	29.04	28.79	28.52	27.94	27.87	27.74	27.71	27.70	27.70	27.90	28.16
VI	25.77	25.73	25.78	25.52	25.27	25.11	25.11	25.15	25.13	25.18	25.29
VII											
(a)	22.08	21.81	21.65	21.46	21.24	21.11	21.04	20.96	20.96	20.89	21.30
(b)	27.02	26.77	26.49	26.40	26.28	26.04	25.98	25.89	25.86	25.84	26.13
VIII	17.93	17.79	17.82	17.74	17.48	17.33	17.22	17.20	17.06	16.99	17.40
IX	21.80	21.53	21.16	20.85	20.61	20.22	19.89	19.80	19.71	19.65	20.31
X	24.95	24.69	24.35	24.29	24.05	23.76	23.69	23.65	23.55	23.51	23.96
XI	28.59	28.29	28.05	28.02	27.87	27.59	27.55	27.58	27.43	27.42	27.85
XII	28.11	27.78	27.76	27.78	27.70	27.61	27.63	27.61	27.67	27.77	27.32
XIII											
(a)	21.12	21.09	20.96	20.86	20.60	20.31	20.24	20.19	20.25	20.33	20.55
(b)	16.06	15.96	15.90	15.85	15.83	15.67	15.54	15.39	15.43	15.60	15.67
XIV	10.16	10.07	9.99	9.85	9.72	9.64	9.67	9.71	9.71	9.81	9.80
XV	15.34	15.42	15.32	15.29	15.27	15.04	14.82	14.60	14.44	14.42	14.65
XVI	18.97	19.06	19.00	18.87	18.49	18.36	18.25	18.23	18.14	18.06	18.29
XVII											
(a)	23.83	23.81	23.67	23.43	23.05	22.74	22.63	22.63	22.66	22.64	22.90
(b)	25.92	25.68	25.08	25.09	24.79	24.69	24.71	24.72	24.70	24.57	25.08
(c)	22.97	23.07	22.99	22.89	22.57	22.65	22.66	22.62	22.64	22.79	22.79
XVIII	28.03	27.95	27.78	27.51	27.20	27.11	27.03	27.01	26.96	26.89	27.28

Days omitted as follows: (a) Aug. 25, 26; (b) Dec. 3-12; (c) Dec. 25, 26; (d) Mar. 4, 13-20, 26; (e) May 6, 11, 20-25; (f) June 8-24; (g) Two dates July 14 on crossing 180° meridian; (h) Sep. 20-Oct. 2; (i) Oct. 18.

Correcting for Excessive Daytime Deck Temperatures

An examination of the original Hartmann and Braun records indicates a diurnal variation in the apparent lapse rate between deck and crosstrees (masthead records were too incomplete for use). As has been suggested, this diurnal variation was no doubt due to the heating of the lower deck thermometer during daylight hours, and from this variation it was possible to correct the mean deck temperatures to values less affected by radiation and absorption. Likewise a diurnal variation in differences between temperatures recorded by the Hartmann and Braun dry-bulb at the crosstrees and the Negretti-Zambra dry-bulb in the deck screen was discovered. The amplitude of this latter variation, however, was not as great as the differences between the two Hartmann and Braun thermometers, presumably because the Negretti-Zambra instrument was better ventilated.

It has seemed justifiable to use curves of these differences for computing corrections for the daytime hourly mean air temperatures recorded by the Negretti-Zambra dry-bulb. The curve of differences during daylight hours between the Negretti-Zambra dry-bulb temperatures on deck and the Hartmann and Braun dry-bulb temperatures at the crosstrees (means for groups) has been applied as a correction to the mean values of air temperature. The resulting mean hourly values for Groups I to XIIIb, corrected for noncyclic change, are given in table 18. Data from the Hartmann and Braun instruments were not complete enough to make these corrections for the remaining groups.

To illustrate the result of applying such corrections, two Groups, VIIa and IX, have been selected and the corrected and uncorrected data plotted in figure 13. The dotted line represents mean air temperature as read from the Negretti-Zambra dry-bulb and corrected from the Assmann readings. The dashed line represents the Negretti-Zambra data corrected by means of the differences between the Hartmann and Braun deck and crosstrees temperatures. The unbroken line represents the air temperatures corrected for the mean differences between the crosstrees temperatures (Hartmann and Braun) and the deck temperatures (Negretti-Zambra). This has been accepted as the most accurate value which can be obtained from the available data. These corrected mean values will be used in many of the air-temperature analyses.

DISCUSSION

General Remarks

The importance of maritime meteorological results increases with the number of observations and the length of the period during which such observations are made. The present results of temperature observations on board the Carnegie, therefore, cannot claim to have a value comparable with those of continental and island meteorological observatories, since the area explored by the Expedition was large, the duration of stay in any given region short, and the climate, particularly with reference to air temperature, heterogeneous.

Table 18. Mean hourly values of air temperature in degrees centigrade for groups, Carnegie, 1928-29

(Corrected for radiation and for noncyclic change)[a]

Group	Dates	No. days	Mean		Local mean hours		
			Latitude	Longitude	0	1	2
	1928		°	°	°	°	°
I	July 29-Aug. 6	9	56.3 N	40.7 W	9.67	9.66	9.60
II	Aug. 7-10	4	42.8 N	47.8 W	17.72	17.65	17.59
III	Aug. 11-23	13	29.0 N	42.0 W	25.89	25.83	25.84
IV	Aug. 24-Sep. 15[b]	21	11.8 N	43.0 W	26.57	26.50	26.45
V	Oct. 2-10	9	13.8 N	71.0 W	27.88	27.88	27.87
VI	Oct. 26-Nov. 6	12	4.0 N	81.0 W	25.17	25.06	24.99
VII							
(a)	Nov. 7-Dec. 21[c]	35	16.5 S	104.3 W	20.88	20.80	20.82
(b)	Feb. 22-28, 1929	7	13.1 S	119.4 W	25.71	25.65	25.57
VIII	Dec. 22-31[d]	8	37.2 S	96.7 W	17.04	16.93	16.86
	1929						
IX	Jan. 1-14	14	24.7 S	83.3 W	19.59	19.51	19.52
X	Feb. 6-17	12	12.3 S	88.2 W	23.52	23.35	23.40
XI	Mar. 1-31[e]	21	16.8 S	147.9 W	27.57	27.26	27.31
XII	Apr. 22-May 31[f]	32	9.7 N	168.7 E	26.51	26.49	26.57
XIII							
(a)	June 1-30[g]	13	34.3 N	143.1 E	20.68	20.50	20.37
(b)	July 1-3	3	39.6 N	149.4 E	15.58	15.36	15.40

Group	Local mean hours										
	3	4	5	6	7	8	9	10	11	12	13
	°	°	°	°	°	°	°	°	°	°	°
I	9.55	9.59	9.56	9.50	9.59	9.64	9.91	10.34	10.38	10.39	10.27
II	17.54	17.44	17.44	17.13	17.19	17.26	17.66	17.75	17.78	17.89	17.68
III	25.82	25.83	25.81	25.75	25.78	26.04	26.13	26.15	26.11	26.26	26.32
IV	26.44	26.48	26.50	26.61	26.84	27.30	27.71	27.68	27.64	27.49	27.60
V	27.69	27.71	27.73	27.97	28.25	28.53	28.39	28.08	28.10	28.39	28.46
VI	25.09	25.10	25.07	24.95	24.95	24.94	24.92	24.91	24.80	25.06	25.20
VII											
(a)	20.82	20.76	20.80	20.97	21.21	21.44	21.67	21.71	21.66	21.64	21.64
(b)	25.58	25.61	25.64	25.63	25.79	26.23	26.37	26.35	26.33	26.28	26.31
VIII	16.89	16.92	16.98	17.13	17.13	17.44	17.48	17.33	17.53	17.60	17.72
IX	19.51	19.47	19.48	19.78	20.06	20.12	20.25	20.44	20.54	20.46	20.49
X	23.43	23.47	23.41	23.54	23.72	23.88	24.03	24.06	24.00	24.08	23.99
XI	27.36	27.33	27.25	27.22	27.63	28.07	28.38	28.50	28.40	28.36	28.28
XII	26.54	26.54	26.53	26.58	26.85	27.17	27.24	27.35	27.55	27.58	27.71
XIII											
(a)	20.23	20.04	19.95	20.12	20.20	20.35	20.48	20.40	20.79	20.92	20.92
(b)	15.11	15.06	15.10	15.17	15.45	15.60	15.80	15.87	15.70	15.51	15.59

Group	Local mean hours										
	14	15	16	17	18	19	20	21	22	23	Mean
	°	°	°	°	°	°	°	°	°	°	°
I	10.22	10.16	10.24	10.12	10.15	9.98	9.92	9.93	9.87	9.72	9.92
II	17.64	17.77	17.85	17.87	18.11	17.84	17.70	17.68	17.88	17.90	17.67
III	26.34	26.46	26.53	26.44	26.30	26.18	26.10	25.99	26.07	25.95	26.08
IV	27.70	27.71	27.42	27.24	27.02	26.95	26.87	26.84	26.80	26.65	27.04
V	28.66	28.60	28.50	27.94	27.87	27.74	27.71	27.70	27.70	27.90	28.05
VI	25.19	25.27	25.49	25.36	25.22	25.12	25.11	25.15	25.13	25.18	25.10
VII											
(a)	21.67	21.55	21.49	21.35	21.15	21.10	21.04	20.96	20.96	20.89	21.21
(b)	26.32	26.25	26.18	26.25	26.24	26.07	26.01	25.92	25.90	25.88	26.90
VIII	17.57	17.60	17.76	17.74	17.48	17.33	17.22	17.20	17.06	16.99	17.29
IX	20.83	20.87	20.87	20.79	20.61	20.22	19.89	19.80	19.71	19.65	20.10
X	24.15	24.16	24.09	24.18	24.03	23.73	23.65	23.61	23.51	23.47	23.77
XI	28.15	28.00	27.88	28.02	27.87	27.59	27.55	27.58	27.43	27.41	27.77
XII	27.88	27.78	27.76	27.78	27.70	27.61	27.63	27.61	27.67	27.77	27.24
XIII											
(a)	21.07	21.09	20.96	20.85	20.60	20.31	20.25	20.19	20.25	20.33	20.49
(b)	15.71	15.63	15.83	15.85	15.83	15.67	15.54	15.39	15.43	15.60	15.53

[a] Radiation corrections from differences between Negretti-Zambra dry-bulb in deck screen, and Hartmann and Braun dry-bulb at crosstrees.

Days omitted as follows: (b) Aug. 25, 26; (c) Dec. 3-12; (d) Dec. 25, 26; (e) Mar. 4, 13-20, 26; (f) May 6, 11, 20-25; (g) June 8-24.

Although a study of air temperatures at sea, and a consideration of differences between sea-surface and air temperatures is of great importance in problems of evaporation, condensation, and precipitation in oceanic regions, a few temperature observations made during short periods over extensive reaches of ocean surface can be expected to have little climatological significance. With these facts recognized, the discussion of air temperatures in this section of the report will be curtailed and only the more important features and relations to other elements will be mentioned. The temperature relations between sea surface and atmosphere will be discussed in greater detail in the chapter on sea-surface temperatures.

The eighteen main groups into which the Carnegie air-temperature data have been divided are not presented as separate and distinct climatological regions, but merely as convenient devices for facilitating the discussion of such data.

Mean Air Temperatures for Groups

The mean hourly values of air temperature for the various groups are presented in tables 17 and 18. These mean values seem to indicate that air temperature is largely a function of latitude. No doubt if the individual groups were smaller, it would be possible to show minor variations in the mean temperatures which were the results of ocean currents or of certain continental influences. It may be observed, however, that the mean air temperature for the Tuamotu Island Group (27°.85) is considerably higher than the mean temperatures for the Coastal Peru and West Callao Groups (20°.31 and 23°.96, respectively), which are in approximately the same latitude. Obviously the mean air temperatures of the latter two Groups are greatly affected by the cold Coastal Peru Current. Similarly, the California and Japan Groups present mean temperatures lower than the mean temperatures for their latitudes because of the effects of the California and Oyashio currents.

Variation of Mean Air Temperature with Latitude

Data concerning the mean air temperatures for the various latitude ranges are presented in figure 14. It may be observed that the mean air temperature increases rapidly from mean latitude 45° to mean latitude 10° north, and that there is then a decrease toward the equator. Evidently air temperatures between latitudes ±5° are greatly influenced by the low sea-surface temperatures encountered by the Carnegie within this range of latitude.

The air temperature-latitude curve in the Southern Hemisphere presents a somewhat similar profile although, in contrast with conditions in the Northern Hemisphere, the mean temperature falls off very slowly between mean latitudes 10° and 20° south. This apparent condition was no doubt brought about by the plan of obtaining temperatures in this region -- the Carnegie re-

Table 19. Difference between temperature readings in degrees centigrade of Hartmann and Braun instruments on deck and on crosstrees for ten days when sky was overcast (particularly during midday hours), Carnegie, 1928-29

Day	Local mean hours											
	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10-11	11-12
1928	°	°	°	°	°	°	°	°	°	°	°	°
Oct. 3	1.1	1.1	1.3	1.1	1.2	1.1	1.1	1.7	2.1	1.2	1.0	0.9
Oct. 4	1.2	1.4	1.5	1.5	1.1	1.5	1.2	1.2	1.2	1.2	0.2	0.7
Oct. 8	1.4	1.3	1.6	1.6	1.3	1.2	1.7	1.5	1.6	1.2	1.4	1.7
Oct. 26	1.5	1.4	1.5	1.8	1.4	1.4	1.4	1.5	0.6	0.7	1.0	1.6
Nov. 2	1.5	1.0	1.1	1.3	1.1	1.2	1.4	1.1	1.1	0.9	1.4	0.8
Dec. 22	1.5	1.2	1.3	1.4	1.6	1.2	1.6	1.3	1.0	0.9	1.0	0.3
1929												
Jan. 7	0.9	1.5	1.5	1.4	1.8	0.8	0.8	1.4	0.9	1.2	1.2	0.8
Jan. 9	1.2	1.4	1.0	1.1	1.2	1.4	1.3	1.3	1.1	1.4	0.8	0.9
Jan. 10	1.2	1.6	1.5	1.3	1.4	1.3	1.6	1.4	1.3	1.6	1.0	1.1
Jan. 11	1.2	1.5	1.3	0.9	1.0	1.3	1.7	1.1	1.4	1.0	1.3	0.6
Mean	1.3	1.3	1.4	1.3	1.3	1.2	1.4	1.4	1.2	1.1	1.0	0.9

Day	Local mean hours											
	12-13	13-14	14-15	15-16	16-17	17-18	18-19	19-20	20-21	21-22	22-23	23-24
1928	°	°	°	°	°	°	°	°	°	°	°	°
Oct. 3	-0.1	-0.2	-1.0	-0.3	-0.1	0.6	1.0	1.2	1.8	1.4	1.1	1.3
Oct. 4	0.8	0.8	1.2	1.1	1.5	1.0	1.4	1.0	1.2	1.2	1.5	1.0
Oct. 8	0.8	0.2	0.9	0.3	1.2	1.2	1.1	1.5	1.2	1.0	1.4	1.0
Oct. 26	1.8	1.0	1.4	1.4	1.5	1.3	1.1	1.7	1.5	1.2	0.9	1.2
Nov. 2	1.0	0.9	0.9	1.4	1.2	1.1	1.5	0.8	1.2	1.4	1.3	1.3
Dec. 22	0.5	0.3	0.9	0.7	0.9	1.3	1.0	1.3	1.3	1.2	1.6	1.5
1929												
Jan. 7	0.7	0.2	0.5	0.8	1.4	0.8	1.0	1.1	1.1	1.4	1.4	1.3
Jan. 9	0.9	0.7	0.7	1.4	1.7	1.4	1.4	1.4	1.0	1.2	1.3	1.3
Jan. 10	0.8	1.2	1.1	0.9	1.2	1.2	1.2	1.3	1.3	0.6	0.9	2.0
Jan. 11	1.0	1.3	1.2	1.3	1.3	1.4	1.5	1.1	1.2	1.4	1.8	1.5
Mean	0.8	0.6	0.8	0.9	1.2	1.1	1.2	1.2	1.3	1.2	1.3	1.3

mained within the Peruvian Current throughout a considerable range of latitude, thus experiencing a greater uniformity of both sea-surface and air temperature.

There is a more rapid decrease in air temperature beyond mean latitude 20° south.

Dry-Bulb Lapse Rates Between Deck, Crosstrees, and Mainmast

As has previously been explained, it was not possible to obtain continuous records of lapse rates from the Hartmann and Braun records at various heights above the deck because of the impossibility of correcting these records for radiation effects. It was hoped, however, that it would be possible to study lapse rates on days when an Assmann calibration was made with the Hartmann and Braun instruments. Unfortunately, these data are extremely fragmentary because of the loss of many original records. The lapse rates recorded were usually normal, but three specific cases have been selected for discussion because they all are decidedly superadiabatic. These data are presented in figure 15. Miss Clarke has previously discussed these unusual lapse rates [23] as follows:

1. July 29, 1928, at 12h, off the coast of Iceland: The dry-bulb at the masthead (34.6 meters above sea level) was 1°.5 lower than the deck dry-bulb, a lapse rate equal to four times the dry adiabatic. The weather was cloudy with a moderate northwest breeze, sea moderate with surface temperature of 11°.6.

2. January 14, 1929, at 10h local mean time, entering the port of Callao: There was a dry-bulb temperature lapse of 2°.1 from deck to crosstrees and of 0°.5 from crosstrees to masthead, a total lapse of 2°.6 in 35 meters or seven times the dry adiabatic. Wind was south southeast, force 3, weather cloudy, sea-surface temperature 18°.8.

3. March 12, 1929, at 11h local mean time, approaching the island of Tahiti: The dry-bulb lapse rate was 2°.0 from deck to crosstrees and 0°.8 from crosstrees to masthead, a total of 2°.8 or seven times the dry adiabatic. Weather was squally with gentle northwest breeze. Sea-surface temperature was 28°.3.

If the deck readings are ignored, the lapse rates between crosstrees and masthead are respectively two, four, and six times the dry adiabatic.

It is not implied that these excessive lapse rates represent actual conditions over the ocean. In all probability the observed values were greatly influenced by radiation from deck, shelter, and sails, but it is possible that such conditions might prevail over a small area for short periods of time.

Maxima and Minima of Air Temperature

The absolute maximum and minimum air temperatures for the various groups are presented in table 21 without comment except to state that in most cases these absolute extremes of temperature were recorded during clear, calm weather, and for this reason were probably influenced by deck temperatures to some extent. Quite frequently the maximum and minimum air temperatures during a 24-hour period occurred at times when the vessel was not under way, and thus when deck

Table 20. Difference between temperature readings in degrees centigrade of Hartmann and Braun instruments on deck and on crosstrees for nine days when sky was partly clear to cloudy (particularly during midday hours), Carnegie, 1928-29

Day	Local mean hours											
	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10-11	11-12
1928	°	°	°	°	°	°	°	°	°	°	°	°
Oct. 5	1.3	1.1	1.3	1.4	1.2	1.1	1.5	2.2	2.0	1.8	1.5	1.2
Nov. 14	1.9	0.9	1.3	1.6	1.4	1.2	1.4	1.8	1.0	0.7	0.3	0.1
Nov. 20	1.3	1.3	1.6	1.6	1.3	1.8	1.7	1.6	1.1	0.9	0.8	0.7
Nov. 27	1.5	0.5	1.5	1.3	1.0	1.3	1.5	1.3	1.5	0.3	0.6	0.3
Dec. 1	1.6	1.2	1.6	1.6	1.5	1.4	1.6	1.6	1.2	0.7	0.7	0.6
Dec. 18	1.7	1.4	1.5	1.5	1.5	1.8	1.3	1.4	1.5	1.2	0.6	0.1
Dec. 25	1.4	1.5	1.4	1.5	1.1	1.3	1.4	1.1	1.4	1.3	1.0	0.8
1929												
Jan. 4	1.5	1.4	1.2	1.7	1.2	1.4	1.0	1.4	1.1	1.3	1.4	0.5
Jan. 13	1.1	1.3	1.1	1.2	1.1	1.3	1.4	1.5	1.2	1.0	0.5	0.0
Mean	1.5	1.2	1.4	1.5	1.3	1.4	1.4	1.5	1.3	1.0	0.8	0.5

Day	Local mean hours											
	12-13	13-14	14-15	15-16	16-17	17-18	18-19	19-20	20-21	21-22	22-23	23-24
1928	°	°	°	°	°	°	°	°	°	°	°	°
Oct. 5	1.1	1.4	1.0	1.6	1.7	1.7	1.3	1.4	1.0	1.4	1.5	1.2
Nov. 14	-0.1	0.9	1.8	1.2	1.1	1.6	1.0	1.5	1.3	1.4	1.4	1.3
Nov. 20	0.0	0.5	1.2	1.2	1.7	1.3	1.3	1.5	1.3	1.1	1.4	1.3
Nov. 27	0.4	-0.1	0.1	0.8	0.9	0.2	1.0	1.6	1.5	1.1	1.5	1.6
Dec. 1	0.1	-0.3	-0.2	0.3	0.8	0.9	1.1	1.3	1.3	1.5	1.6	1.5
Dec. 18	0.4	0.5	0.8	0.4	0.4	1.0	1.1	1.4	1.7	1.8	1.5	1.5
Dec. 25	0.4	0.4	0.4	0.7	0.7	0.9	1.1	1.0	1.5	1.3	1.2	1.4
1929												
Jan. 4	-0.1	-0.5	-0.7	-0.6	-0.2	0.5	0.8	0.7	1.1	1.7	1.7	1.5
Jan. 13	0.5	0.1	0.6	0.7	1.5	1.1	2.0	1.3	1.3	1.3	1.4	1.3
Mean	0.3	0.3	0.6	0.7	1.0	1.0	1.2	1.3	1.3	1.4	1.5	1.4

Table 21. Absolute maximum and minimum air temperatures in degrees centigrade for groups, Carnegie, 1928-29

Group	No. days	Maximum	Minimum	Daily range	
				Maximum	Minimum
		°	°	°	°
I	9	13.1	8.4	3.6	0.8
II	4	25.1	11.9	4.5	2.9[b]
III	13	28.2	23.9	3.0	1.5
IV	21	30.6	24.2	5.0	1.3
V	9	30.5	25.1	3.5	1.3
VI	12	29.2	22.3	4.2	1.0
VII					
(a)	35	24.2	18.0	4.8	0.6
(b)	7	28.0	24.5	2.0	1.2
VIII	8	22.6	14.9	3.2	1.3
IX	14	25.2	17.7	5.7	1.2
X	12	27.6	21.1	4.6	1.0
XI	21	31.0	24.1	5.0	1.4
XII	32	31.2	24.2	3.3	0.8
XIII					
(a)	13	26.2	15.9	4.0	0.9
(b)	3	18.2	13.4	2.4	1.3
XIV	19	14.1	6.3[a]	3.4	0.4[a]
XV	7	17.6	11.3	3.5	1.6
XVI	5	21.8	14.2	3.5	1.3
XVII					
(a)	8	25.8	20.7	4.0	1.1
(b)	8	27.5	22.5	4.0	1.7
(c)	14	25.9	19.2	4.0	0.6
XVIII	20	32.5[b]	24.0	5.2	0.9

[a] Absolute minimum values for cruise.
[b] Absolute maximum values for cruise.

ventilation was at a minimum.

The absolute maximum temperature of the cruise (32°.5) was recorded on November 14, 1929, at 13h in latitude 11°.6 south, longitude 163°.4 west. The absolute minimum temperature (6°.3) was noted on July 8, 1929, during 19h to 20h in latitude 46°.9 north, longitude 163° west. The greatest daily range of air temperature (5°.7) was registered off the coast of Chile on January 2, 1929, during a period of nearly dead calm.

The mean daily maximum and minimum temperatures for the various groups are listed in table 22. The highest mean maximum air temperature and also the highest mean minimum, 29°.4 and 26°.6 respectively, were recorded in the Caribbean Group between October 2 and 10, 1928. The lowest mean maximum temperature (10°.6) occurred in the Alaskan Peninsula Group between July 4 and 21, 1929, whereas the lowest mean minimum air temperature occurred in the South Greenland Group for the period between July 29 and August 6, 1928.

As shown in table 23, there appears to be considerable variation in the time of occurrence of maximum and minimum temperatures between the various Groups. No doubt much of this variation can be assigned to the unsymmetrical distribution of data with respect to season, latitude, and distance from continental land masses. In addition, since the diurnal and interdiurnal variations of air temperature are everywhere small and, in many cases, the number of days of observation few, there is considerable opportunity for chance variations. In fact, merely raising or lowering the mean hourly temperature a fraction of a degree at some given hour within a Group would, in several instances, retard or advance the time

Table 22. Mean daily maximum and minimum air temperatures in degrees centigrade for groups, Carnegie, 1928-29

Group	No. days	Mean		
		Maximum[a]	Minimum[a]	Daily range[a]
		°	°	°
I	9	11.2	8.8	2.4
II	4	19.9	16.1	3.8
III	13	27.5	25.2	2.3
IV	21	28.9	25.7	3.2
V	9	29.4	26.6	2.8
VI	12	26.5	23.9	2.6
VII				
(a)	35	22.3	20.2	2.1
(b)	7	27.1	25.4	1.7
VIII	8	18.5	16.3	2.2
IX	14	22.1	19.0	3.1
X	12	25.2	22.9	2.3
XI	21	29.2	26.5	2.7
XII	32	28.1	26.2	1.9
XIII				
(a)	13	22.0	19.3	2.7
(b)	3	16.8	14.9	1.9
XIV	19	10.6	9.2	1.4
XV	7	15.6	13.2	2.4
XVI	5	19.4	17.0	2.4
XVII				
(a)	8	24.1	22.0	2.1
(b)	8	26.5	24.0	2.5
(c)	14	24.0	21.7	2.3
XVIII	20	28.6	26.2	2.4
Weighted mean		23.90	21.54	2.36

[a] Unperiodic.

Table 23. Hour of mean maximum and minimum air temperature in degrees centigrade for groups, Carnegie, 1928-29

Group	LMT	Mean maximum temperature[a]	LMT	Mean minimum temperature[a]
	h	°	h	°
I	16	10.77	6	9.50
II	18	18.62	6	17.13
III	13	27.31	6	25.75
IV	11	28.60	3	26.44
V	14	22.04	3	27.69
VI	13	25.84	6	24.95
VII				
(a)	13	22.13	4	20.76
(b)	14	27.02	2-3	25.61
VIII	13	18.21	2	16.86
IX	14	21.80	4	19.47
X	14	24.95	1	23.31
XI	13	28.91	1	27.25
XII	13	28.16	1	26.49
XIII				
(a)	12	21.18	5	19.95
(b)	10	16.34	4	15.06
XIV	14	10.16	8	9.49
XV	15	15.42	5	13.99
XVI	15	19.06	1	17.86
XVII				
(a)	14	23.83	3	22.20
(b)	12	26.26	24	24.43
(c)	15	23.07	3	22.48
XVIII	12	28.20	6	26.68
Weighted mean	13.3	.....	3.6	.....

[a] Periodic.

of maximum or minimum temperature for the group by many hours (table 17).

The frequencies of hours of occurrence of maximum and minimum air temperatures are presented in tables 24 and 25, which show that the maximum temperature for all Groups occurs most frequently at 13h, and that the most frequent hour of minimum temperature occurrence is 05h. The curve for the distribution of maximum temperatures by hours is interesting in that there is an apparent secondary maximum frequency at midnight.

Table 24. Frequencies of hours of maximum air temperature by groups, Carnegie, 1928-29

Group	Local mean hours																						
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
I	...	...	...	...	...	...	...	...	...	...	3	...	1	2	1	3	2	2	...	...	...	...	...	...
II	1	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	1	1	...	...	...	...	1
III	...	...	...	...	...	...	...	...	...	...	1	1	4	4	4	3	3	1	...	...	...	...	...	...
IV	...	...	...	...	...	...	...	...	...	...	5	4	3	7	3	5	...	...	...	...	...	...	1	1
V	...	...	...	...	...	...	...	1	...	1	...	...	2	2	4	...	...	...	...	...	...	...	...	...
VI	3	1	...	...	...	1	...	...	1	1	...	1	3	...	1	1	2	...	...	...	...	1	...	...
VII																								
(a)	...	...	...	...	...	...	...	...	...	4	5	11	12	8	12	4	3	...	...	...	...	...	...	...
(b)	...	...	...	...	...	...	...	...	...	...	...	1	1	4	7	1	1	...	...	...	...	...	...	...
VIII	2	1	...	...	...	...	...	...	...	1	1	2	1	2	1	...	...	1	...	...	...	...	...	...
IX	...	...	...	...	...	...	...	...	...	...	1	4	2	2	4	4	2	1	...	...	...	...	...	...
X	...	...	...	...	...	...	...	...	...	...	...	3	4	3	3	2	...	...	...	...	...	...	...	...
XI	...	...	1	...	...	...	...	...	...	...	2	3	3	8	5	2	1	1	...	...	...	...	...	...
XII	1	...	...	...	...	...	...	...	...	1	3	8	15	13	5	1	...	3	...	...	...	...	...	1
XIII																								
(a)	5	...	...	...	...	...	...	...	...	...	...	4	2	3	...	1	1	...	...	...	...	...	1	...
(b)	...	...	...	...	...	...	...	...	...	1	1	1	...	...	...	...	...	...	...	...	...	...	...	...
XIV	3	4	1	1	...	...	1	...	...	...	2	...	2	3	3	4	1	2	...	...	...	...	...	2
XV	...	...	...	...	...	...	...	...	...	...	...	...	1	1	1	2	...	1	...	...	1	...	...	1
XVI	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	2	1	1	...	...	...	...	...
XVII																								
(a)	...	...	...	...	...	...	...	...	...	...	...	...	1	2	2	2	1	1	...	...	...	...	...	...
(b)	...	...	...	...	...	...	...	...	...	...	...	1	4	2	1	...	...	...	...	...	...	...	...	...
(c)	1	...	...	...	...	...	1	...	...	1	3	2	2	1	2	1	1	...	...	...	...	...	...	2
XVIII	1	...	...	...	...	...	...	...	...	2	3	1	2	6	5	2	2	...	...	...	...	...	1	1
Total	17	6	2	1	0	1	2	1	1	12	30	48	65	74	64	38	22	15	2	0	1	1	3	9

Table 25. Frequencies of hours of minimum air temperature by groups, Carnegie, 1928-29

Group	Local mean hours																						
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
I	3	3	2	2	...	1	4	2	...	...	...	...	...	...	...	...	...	...	...	...	1	1	1	2
II	2	1	1	1	...	1	1	1	1	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...
III	2	3	2	2	5	3	3	2	2	...	...	...	...	...	...	...	...	...	...	...	...	...	1	1
IV	1	2	4	5	4	6	2	1	1	...	...	...	...	...	...	...	...	1	...	1	1	1	...	2
V	1	2	2	3	2	2	1	...	...	...	...	1	...	...	...	...	...	1	...	...	2	1	1	1
VI	2	1	...	...	1	1	2	...	...	1	...	2	...	1	1	2	...	...	...	1	1	2	1	1
VII																								
(a)	2	8	8	8	7	4	1	1	1	...	...	...	...	...	...	...	1	1	...	...	...	3	1	9
(b)	...	2	5	3	3	1	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
VIII	1	1	2	1	1	1	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	3
IX	2	3	3	4	5	2	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	3	4
X	2	2	4	2	3	2	...	1	...	1	...	1	...	...	...	...	...	...	...	1	...	...	...	3
XI	2	3	2	3	4	6	7	...	1	...	1	1	...	...	...	...	2	...	...	2	...	...	1	...
XII	5	3	2	4	5	10	4	3	1	1	...	...	...	...	1	1	...	...	2	1	1	4	1	3
XIII																								
(a)	...	...	...	2	1	2	1	1	...	...	...	...	...	...	...	...	...	...	1	2	1	2	1	3
(b)	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	2	1	2	1	3
XIV	2	2	1	4	5	3	3	6	5	4	2	...	...	...	...	...	...	...	...	1	1	1	...	1
XV	1	...	2	...	1	1	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
XVI	2	1	...	...	...	...	...	...	...	1	1	...	...	...	...	...	...	...	...	...	...	...	...	...
XVII																								
(a)	2	2	3	4	...	2	2	...	...	...	...	...	...	...	...	...	...	...	...	...	....	...	...	...
(b)	4	2	2	1	1	1	...	...	...	...	...	...	...	...	...	...	...	...	1	1	...	...	1	4
(c)	2	2	1	...	...	3	3	2	...	...	...	...	...	...	2	...	1	...	1	...	...	1	1	1
XVIII	3	3	3	2	5	6	4	3	...	...	1	...	...	...	...	...	...	...	1	...	...	1	...	1
Total	41	47	49	51	53	58	41	24	12	9	5	5	0	1	4	3	4	3	8	12	9	19	14	43

Obviously this apparent condition is unreal and arises from the fact that the data have not been corrected for noncyclic changes in this case. In a vessel which is moving from warmer to colder latitudes there is a possibility that the variation of air temperature may be greater, owing to its motion, than the usual diurnal variation of temperature. This would tend to place the maximum temperature for the 24-hour period at 00h, or the first observation of the day. Similarly, on a vessel which is moving from colder to warmer regions, there would be a tendency to record the maximum temperature at 23h, or the last observation of the 24-hour period. This fact demonstrates the necessity for properly evaluating meteorological data obtained on shipboard before attempting to interpret such data.

Taking these data on the whole, the results do not agree well with those drawn by Visser [24] and Braak [25] for several tropical regions. From observations made during three cruises of the Snellius in the Netherlands East Indies during 1929-1930, Visser has made note of the fact that the maximum air temperatures in this region occur between 18h and 20h, and the minima at 06h. These results apply to data recorded in areas more than 100 km from the coast, and should thus be comparable with the Carnegie results. Braak, using air-temperature data obtained between Ambon and Batavia, found the highest air temperatures occurring between 16h and 20h. Visser does mention the fact, however, that this retardation of maximum temperature does not occur to such a degree on the open ocean as is obvious from different instances quoted in Hann's Handbook [26]. No doubt the extreme retardation of maximum temperature in this region is due to excessive rainfall.

Diurnal Variation of Air Temperature

General Remarks

A study of the frequency distribution of the unperiodic diurnal amplitude of air temperature indicates that the daily range over the oceans is usually small when compared with ranges in continental or insular areas. Table 26 shows that the diurnal variation of temperature on the Carnegie was less than 3° on 71 per cent of the days. This result is not surprising when we consider the efficiency of the ocean as an energy-absorbing and storing unit.

Diurnal Variation of Mean Hourly Air Temperature for all Days

As shown in figure 16, the mean hourly air temperatures for all days of the cruise present a fairly smooth curve with a definite maximum at 13h and the minimum at 05h. These results compare well with the frequencies of hours of occurrence of maximum and minimum air temperatures (tables 24, 25).

Variation of the Diurnal Amplitude of Air Temperature with Latitude

Assuming all heat-transport factors equal, we should expect the diurnal amplitude of air temperature over the ocean to be greatest within the ranges of latitude wherein air temperatures are highest, and conversely. Comparing figure 14 with figure 18, however, it is found that this is not the case with the Carnegie air-temperature data. Figure 18 shows that the diurnal amplitude of air temperature on the Carnegie varies inversely with mean wind velocity. Obviously, large diurnal amplitudes are due in great measure to insufficient ventilation of the thermometer screens during periods with low wind velocities. For this reason it is impossible to determine with accuracy the comparative amplitudes of the diurnal variations in air temperature for the various latitude ranges over the ocean from the Carnegie data.

Table 26. Frequency distribution of the unperiodic diurnal amplitude of air temperature, Carnegie, 1928-29

Temperature range	No. days	Percentage of total	Cumulative percentage	
°C				
< 1	14	5	5	100
1-2	105	34	34	95
2-3	98	32	71	61
3-4	57	19	90	29
> 4	32	10	100	10
Total	306	100	....	....

Effect of Wind on the Diurnal Variation of Air Temperature

As has just been indicated, wind appears to be the most important single factor in determining the amplitude of the diurnal variation of air temperature over the sea; that is, a smaller amplitude appears with the higher wind velocities. The reasons for such effects (in the case of air temperature) are two: one the mixing of surface layers of air due to greater mechanical turbulence, and the other the result of better ventilation of the thermometers. Although the wind data are not available in detail, it has been possible (from data in the log abstract) to select fifty-three days in tropical regions with an average wind force equal to or greater than 4 on the Beaufort scale, and fifty-three days within the same general regions, with wind force less than 4. The results give an amplitude of 1°.79 for days with a wind force equal to or greater than 4, and one of 3°.05 for days with wind force less than 4.

An attempt was made to undertake a similar study of the effect of cloudiness on the diurnal variation of air temperature, but it was found that the records of cloudiness in the log abstract were not complete enough to allow the division of a sufficient number of days into appropriate groups.

Diurnal Waves of Air Temperature and Pressure Compared

Investigators appear to agree that the diurnal variabilities of pressure are directly related to the rhythmic heating and cooling of the atmosphere. In this connection, therefore, it has seemed valuable to summarize the Carnegie air-temperature data in the same manner as the pressure data.

The hourly values of air temperature, as given in table 78 of appendix III, were collected for each ten-degree range of latitude as was done for the pressure data. The departures of the mean 24-hourly air temperatures from the mean daily temperatures were determined for each range of latitude, and the mean diurnal variation

Table 27. Results of Fourier analyses of diurnal variation of air temperature for groups, Carnegie, 1928-29

Group	Coefficients							
	a_1	a_2	a_3	a_4	b_1	b_2	b_3	b_4
	°C	°C	°C	°C	°C	°C	°C	°C
I	-.458	+.095	-.038	+.024	-.416	+.101	+.059	-.064
II	-.277	+.107	-.008	+.058	-.507	+.150	+.096	-.092
III	-.609	+.181	-.012	+.018	-.410	+.209	-.004	-.066
IV	-.974	+.334	-.030	-.046	-.279	-.003	+.031	-.049
V	-.563	+.222	+.112	-.043	+.007	+.063	-.084	+.100
VI	-.289	+.107	+.033	-.022	-.164	+.114	-.046	-.028
VII								
(a)	-.621	+.188	+.007	-.016	-.120	-.012	+.003	+.016
(b)	-.541	+.151	+.017	-.027	-.246	+.039	-.032	+.031
VIII	-.539	+.105	+.009	+.013	-.167	-.015	+.012	+.002
IX	-.956	+.173	+.073	-.026	-.371	+.119	-.028	+.028
X	-.703	+.187	-.006	-.022	-.209	+.036	-.019	+.003
XI	-.672	+.271	-.023	-.016	-.138	-.049	+.052	+.010
XII	-.507	+.168	-.082	-.055	-.534	-.195	-.079	-.077
XIII								
(a)	-.369	+.251	+.084	+.051	-.210	+.129	+.056	-.005
(b)	-.410	+.192	+.082	-.001	-.169	-.109	+.134	-.037
XIV	-.059	+.154	+.007	+.025	-.118	+.160	-.037	+.022
XV	-.331	-.013	+.032	+.018	-.480	+.120	+.014	+.045
XVI	-.307	-.018	-.015	-.023	-.323	+.198	-.064	-.082
XVII								
(a)	-.522	+.142	+.106	-.020	-.344	+.150	-.048	-.030
(b)	-.743	+.305	-.078	-.084	-.011	-.033	+.033	+.016
(c)	-.240	+.100	+.059	-.019	-.032	-.035	-.004	-.058
XVIII	-.637	+.245	+.007	-.083	-.197	+.006	+.063	-.036

Group	Amplitudes				Phase angles			
	c_1	c_2	c_3	c_4	ϕ_1	ϕ_2	ϕ_3	ϕ_4
	°C	°C	°C	°C	°	°	°	°
I	0.619	.139	.070	.068	227.8	43.2	327.2	159.4
II	0.578	.184	.096	.109	208.7	35.5	355.2	147.8
III	0.735	.276	.013	.068	236.1	40.9	251.6	164.7
IV	1.013	.334	.043	.067	254.0	90.5	315.9	223.2
V	0.563	.231	.140	.109	270.7	74.2	126.9	336.7
VI	0.332	.156	.057	.036	240.4	43.2	144.3	218.2
VII								
(a)	0.594	.156	.036	.041	245.5	75.5	152.0	318.9
(b)	0.632	.188	.008	.023	259.1	93.7	66.8	315.0
VIII	0.564	.106	.015	.013	252.8	98.1	36.9	81.3
IX	1.025	.210	.078	.038	248.8	55.5	111.0	317.1
X	0.733	.190	.020	.022	253.4	79.1	197.5	277.8
XI	0.686	.275	.057	.019	258.4	100.3	336.1	302.0
XII	0.737	.257	.114	.095	223.5	139.3	226.1	215.5
XIII								
(a)	0.424	.282	.101	.051	240.4	62.8	56.3	95.6
(b)	0.445	.221	.157	.037	247.6	119.6	31.5	181.5
XIV	0.132	.222	.038	.033	206.6	43.9	169.3	48.7
XV	0.583	.121	.035	.049	214.6	353.8	66.4	21.8
XVI	0.446	.199	.066	.085	223.5	354.8	193.2	195.7
XVII								
(a)	0.625	.206	.116	.036	236.6	43.4	114.4	213.7
(b)	0.743	.307	.085	.086	269.2	96.2	292.9	280.8
(c)	0.242	.106	.059	.061	262.4	109.3	93.9	198.1
XVIII	0.667	.245	.063	.091	252.8	88.6	6.3	246.6

corrected for noncyclic change. These corrected mean hourly departures of air temperature are given in table 28, and the mean diurnal curves in figure 19. Unfortunately, the number of days included in each range of latitude for the pressure and temperature data are not equal owing to instrumental difficulties previously described, with the result that more days are included in the means of pressure than in the means of temperature.

The mean hourly departures of air temperature were analyzed in the same manner as the departures of atmospheric pressure in order to obtain the Fourier quantities for the 24-, 12-, 8-, and 6-hour waves (table 27).

Figure 20 has been prepared to show the mean amplitudes of the 24-, 12-, 8-, and 6-hour oscillations of air temperature and pressure for the several ranges of latitude. One conspicuous feature of this diagram is the large diurnal amplitude of air temperature, c_1, compared with the semidiurnal term, c_2. Between latitudes ±20°, the 24-hour term averages 2.8 times larger than the 12-hour term. It appears necessary, however, to

Table 28. Mean hourly departures of air temperature in degrees centigrade according to latitude ranges, Carnegie, 1928-29

LMT	65°-55°N 6 days July-Aug.	55°-45°N, 21 days, July-Aug.	45°-35°N, 26 days, June-Sep.	35°-25°N, 40 days, May-June Aug.-Oct.	25°-15°N, 32 days, May and Aug.-Nov.	15°-5°N, 46 days, May and Aug.-Nov
h	°C	°C	°C	°C	°C	°C
0	-.41	+.01	-.17	-.28	-.34	-.44
1	-.46	+.06	-.33	-.34	-.36	-.57
2	-.55	+.03	-.44	-.41	-.32	-.64[a]
3	-.65[a]	-.03	-.47	-.50	-.41	-.62
4	-.59	-.12	-.50	-.48	-.45	-.60
5	-.53	-.18	-.52[a]	-.54[a]	-.47	-.64[a]
6	-.59	-.23	-.49	-.50	-.50[a]	-.53
7	-.51	-.27	-.39	-.35	-.21	-.32
8	-.36	-.34	-.31	-.11	-.02	+.06
9	-.15	-.26	-.09	+.07	+.16	+.42
10	+.39	-.08	+.12	+.30	+.40	+.72
11	+.53	+.12	+.32	+.55	+.42	+.91
12	+.57	+.34	+.46	+.63	+.59	+1.02[a]
13	+.52	+.43[a]	+.52	+.70	+.66	+.93
14	+.69[a]	+.43[a]	+.59	+.76[a]	+.69[a]	+.88
15	+.59	+.42	+.64[a]	+.76[a]	+.49	+.70
16	+.68	+.32	+.64[a]	+.54	+.30	+.43
17	+.51	+.16	+.57	+.36	+.23	+.13
18	+.44	+.09	+.39	.00	+.05	-.12
19	+.25	-.06	+.08	-.17	-.07	-.27
20	+.08	-.11	-.07	-.24	-.11	-.32
21	-.11	-.15	-.14	-.22	-.22	-.34
22	-.15	-.16	-.14	-.20	-.16	-.40
23	-.25	-.09	-.10	-.19	-.22	-.40
24	-.41	+.01	-.17	-.28	-.34	-.44
Mean	10.12	9.92	17.80	22.96	26.42	27.09
Average departure	±0.44	±0.18	±0.35	±0.38	±0.33	±0.51
Amplitude	1.34	0.77	1.16	1.30	1.19	1.66

LMT	5°N-5°S, 33 days, April-May Oct.-Nov.	5°-15°S, 36 days, Nov. and Jan.-Apr.	15°-25°S, 31 days, Nov. and Jan.-Mar.	25°-35°S, 25 days, Nov.-Jan.	35°-45°S, 9 days, Dec.
h	°C	°C	°C	°C	°C
0	-.36	-.46	-.34	-.62	-.50
1	-.41	-.53[a]	-.58[a]	-.66	-.59
2	-.40	-.48	-.51	-.69	-.62[a]
3	-.43	-.50	-.47	-.69	-.60
4	-.47[a]	-.49	-.52	-.77[a]	-.61
5	-.42	-.53[a]	-.56	+.73	-.55
6	-.42	-.50	-.55	-.42	-.44
7	-.19	-.30	-.28	-.11	-.32
8	+.14	+.12	+.07	+.11	+.05
9	+.33	+.37	+.36	+.34	+.31
10	+.44	+.62	+.63	+.62	+.38
11	+.53	+.86	+.71	+.80	+.57
12	+.68[a]	+.95	+.78	+.84	+.66
13	+.68[a]	+1.01[a]	+.88[a]	+.93	+.75
14	+.64	+.85	+.77	+1.04[a]	+.82[a]
15	+.50	+.51	+.51	+.78	+.74
16	+.41	+.29	+.26	+.61	+.62
17	+.12	+.20	+.19	+.40	+.36
18	-.14	-.03	+.01	+.12	+.17
19	-.11	-.23	-.19	-.14	-.01
20	-.26	-.35	-.22	-.34	-.16
21	-.26	-.42	-.22	-.45	-.25
22	-.32	-.44	-.32	-.48	-.39
23	-.34	-.44	-.36	-.56	-.50
24	-.36	-.46	-.34	-.62	-.50
Mean	24.02	25.89	25.71	20.82	16.98
Average departure	±0.38	±0.48	±0.42	±0.55	±0.46
Amplitude	1.15	1.54	1.46	1.81	1.44

[a] Extreme mean values.

Table 29. Harmonic coefficients of diurnal waves of air temperature, Carnegie, 1928-29

Designation	Latitude range and number of days of record					
	65°N-55°N, 6 days, July-Aug.	55°N-45°N, 21 days, July-Aug.	45°N-35°N, 26 days, June-Sep.	35°N-25°N, 40 days, May-June Aug.-Oct.	25°N-15°N, 32 days, May and Aug.-Nov.	15°N-5°N, 46 days, May and Aug.-Nov.
			Coefficients, °C			
a_1	-0.460	-0.143	-0.369	-0.486	-0.441	-0.725
a_2	+0.097	+0.129	+0.100	+0.205	+0.165	+0.280
a_3	-0.022	-0.014	+0.054	+0.058	+0.007	+0.008
a_4	+0.021	+0.033	+0.035	-0.024	-0.030	-0.026
b_1	-0.444	-0.159	+0.384	-0.266	-0.201	-0.176
b_2	+0.044	+0.192	+0.095	+0.101	+0.021	+0.002
b_3	+0.049	-0.001	+0.015	-0.023	+0.008	+0.014
b_4	-0.061	+0.019	-0.047	-0.027	+0.025	-0.022
			Amplitude, °C			
c_1	0.639	0.213	0.533	0.554	0.484	0.746
c_2	0.106	0.231	0.138	0.228	0.166	0.280
c_3	0.054	0.014	0.056	0.062	0.011	0.016
c_4	0.064	0.038	0.059	0.036	0.039	0.034
			Phase angle, °			
ϕ_1	226.0	222.0	223.9	241.2	245.5	256.4
ϕ_2	65.6	33.9	46.5	63.8	82.8	89.6
ϕ_3	335.8	265.9	74.5	111.6	41.2	29.7
ϕ_4	161.0	60.1	143.3	221.6	309.8	229.8

Designation	Latitude range and number of days of record					
	5°N-5°S, 33 days, Apr.-May Oct.-Nov.	5°S-15°S, 38 days, Nov. and Jan.-Apr.	15°S-25°S, 31 days, Nov. and Jan.-Mar.	25°S-35°S, 25 days, Nov.-Jan.	35°S-45°S, 9 days, Dec.	15°N-15°S, 117 days,
			Coefficients, °C			
a_1	-0.517	-0.678	-0.598	-0.791	-0.631	-0.640[a]
a_2	+0.167	+0.252	+0.226	+0.158	+0.098	+0.233[a]
a_3	+0.027	-0.026	-0.016	+0.062	+0.032	+0.003[a]
a_4	-0.034	+0.001	-0.035	-0.008	-0.036	-0.020[a]
b_1	-0.140	-0.139	-0.187	-0.245	-0.285	-0.152[a]
b_2	+0.017	+0.034	-0.015	+0.037	+0.037	+0.018[a]
b_3	+0.014	+0.039	+0.030	+0.004	+0.005	+0.022[a]
b_4	+0.014	+0.009	+0.002	+0.026	+0.009	0.000[a]
			Amplitude, °C			
c_1	0.536	0.692	0.627	0.828	0.693	0.657
c_2	0.168	0.254	0.226	0.162	0.105	0.234
c_3	0.030	0.047	0.034	0.062	0.032	0.022
c_4	0.037	0.009	0.035	0.027	0.037	0.020
			Phase angle, °			
ϕ_1	254.8	258.4	252.6	252.8	245.7	256.6
ϕ_2	84.2	82.3	93.8	76.8	69.3	85.6
ϕ_3	62.8	326.3	331.9	86.3	81.1	7.8
ϕ_4	292.4	6.3	273.3	342.9	284.0	270.0

[a] These are means for latitude zones 15° N-5° N, 5° N, 5° N-5° S, and 5° S-15° S, and from these amplitudes, c, and phase angles, ϕ, were determined.

apply certain corrections to these coefficients since, as has been brought out in the discussion of the measurement of air temperature on board ship (p. 13), the air temperatures recorded in the Stevenson screen on deck are probably too high during daylight hours to represent correctly temperature conditions within the free air at similar heights above the sea (3.6 meters). In order partially to offset this effect, the corrections to the air-temperature data (from the diurnal variability of the differences between dry-bulb at deck and crosstrees) have been arranged according to ranges of latitude, corrected for noncyclic change, and subjected to harmonic analysis. The coefficients, a and b, have then been subtracted from similar values of the original analyses, and the corrected amplitudes, c and ϕ, computed. These corrected temperatures and amplitudes, c_1 and c_2, are shown in figure 20. Corrections were not determined for c_3 and c_4. Using these corrected values we find that between latitudes $\pm 20°$, the 24-hour term averages four times larger than the 12-hour term. One cannot claim great reliability for these corrected values (table 30), though they more nearly represent the actual unaffected air temperatures, and demonstrate the necessity for obtaining true values before drawing conclusions regarding relations between the diurnal oscillations of pressure and temperature. Correcting the Fourier coefficients of

Table 30. Corrected values of Fourier coefficients, amplitudes, and phase angles of the 24-hourly and 12-hourly oscillations of air temperature, Carnegie, 1928-29[a]

Designation	Latitude range and number of days used in determining corrections					
	65°N-55°N, 4 days	55°N-45°N, 19 days	45°N-35°N, 22 days	35°N-25°N, 26 days	25°N-15°N, 21 days	15°N-5°N, 31 days
			Coefficients, °C			
a_1	-0.390	-0.202	-0.247	-0.371	-0.293	-0.429
a_2	+0.056	+0.057	-0.014	+0.106	-0.036	+0.110
b_1	-0.159	-0.096	-0.366	-0.234	-0.162	-0.117
b_2	-0.097	+0.051	+0.002	+0.004	-0.005	-0.034
			Amplitudes, °C			
c_1	0.421	0.224	0.442	0.440	0.335	0.445
c_2	0.112	0.082	0.014	0.106	0.036	0.115
			Phase angles, °			
ϕ_1	247.8	244.6	214.0	237.8	241.1	254.7
ϕ_2	150.0	48.2	278.1	87.8	262.1	107.2

Designation	Latitude range and number of days used in determining corrections					
	5°N-5°S, 25 days	5°S-15°S, 29 days	15°S-25°S, 29 days	25°S-35°S, 21 days	35°S-45°S, 7 days	15°N-15°S, 85 days
			Coefficients, °C			
a_1	-0.274	-0.429	-0.442	-0.453	-0.460	-0.377[b]
a_2	+0.072	+0.094	+0.106	+0.024	+0.035	+0.092[b]
b_1	-0.111	-0.128	-0.119	-0.197	-0.362	-0.119[b]
b_2	-0.038	-0.046	-0.147	-0.042	+0.027	-0.039[b]
			Amplitudes, °C			
c_1	0.296	0.448	0.458	0.494	0.585	0.395
c_2	0.081	0.105	0.181	0.048	0.044	0.100
			Phase angles, °			
ϕ_1	247.9	253.4	254.9	246.5	231.8	252.5
ϕ_2	117.8	116.1	144.2	150.3	52.4	113.0

[a] Corrections obtained from difference between dry-bulb readings in screen on deck and at the crosstrees.

[b] These are means for latitude zones 15° N-5° N, 5° N-5° S, and 5° S-15° S, and from these amplitudes, c, and phase angles, ϕ, were determined.

air temperature for excesses during daylight hours in tropical regions of the Pacific Ocean (between latitudes ±15°) decreases the amplitude c_2 by almost one-half and increases the phase angle, ϕ_2, by 27°. The maximum amplitude thus occurs almost one hour earlier.

It now appears that previous measurements of air temperature on board vessels at sea have been too high, at least by several tenths of a degree, and that amplitudes obtained from the uncorrected temperatures over the ocean are in error. If this is the case, then certain theoretical considerations regarding the dynamics of these oscillations, such as Chapman's [27], will need modification.

From data obtained during the Meteor Expedition (1925-1927), Kuhlbrodt and Reger [28] found the diurnal variation of air temperature to be of the order of 0°.3, somewhat smaller than is indicated by the Carnegie amplitudes for c_1.

The diurnal variation of temperature is large compared with the semidiurnal variation, in direct contrast with the case of pressure. In the latter case, the amplitude of the 12-hour wave is greater than that of the 24-hour. Within latitudes ±20°, the Carnegie mean amplitudes of the 12-hour waves of pressure average roughly three times the amplitude of the 24-hour wave. The difference in phase between the 12-hour pressure wave and the 12-hour temperature oscillation averages approximately 72°, which is equivalent to stating that the time of maximum pressure occurs 2.4 hours earlier than the time of maximum air temperature. For uncorrected data (table 27), the phase differences are more irregular, but between latitudes ±20° the time of maximum pressure averages only 1.5 hours earlier than the time of maximum air temperature.

Bartels [9, pp. 17-19] has considered the relations between the 8-hour terms of pressure and temperature for certain European stations. Chapman [27], Pramanik [19], and Topping [29] have collected and analyzed data for several land stations during January and July. They found the phase to be fairly regular in summer and the amplitude generally greater in winter. Bartels found the amplitude of this temperature wave for Potsdam to be least at the equinoxes. The Carnegie coefficients of the 8-hour temperature oscillations are so irregular that they cannot be said to verify any of the above conclusions. The amplitudes and phase angles of this wave as given by Chapman, Pramanik, and Topping for Mauritius and Ascension for January are: Mauritius (20° 06′ south), $c_3 = 0°.35$ C, $\phi_3 = 35°$; Ascension (7° 55′ south), $c_3 = 0°.38$ C, $\phi_3 = 45°$. According to the Carnegie observations, the amplitude of this oscillation is considerably smaller than the values given above. The Carnegie observations for mean latitudes 15° to 25° south (31 days, November and January - March) and for mean latitudes

5° to 15° south (38 days, November and January - April) show: latitudes 15° - 25° south, c_3=0.°034C, ϕ_3=331.°9; latitudes 5° - 15° south, c_3=0.°047C, ϕ_3=326.°3.

For equatorial and tropical regions, between latitudes ±20°, the amplitude of the 8-hour temperature oscillation, as computed from the Carnegie data, is about one-tenth the amplitude of the 12-hour oscillation. There appears to be little regularity in the differences of phase between the two temperature waves; the maximum pressure varies from 3.8 hours earlier to 2.8 hours later than the maximum temperature. Between latitudes ±20°, the time of maximum pressure averages 2.3 hours earlier, a result which compares favorably with the figures of Bartels [29] for Potsdam, where the pressure maximum in summer averaged 2.0 hours earlier than the temperature maximum.

Finally, brief mention should be made of the 6-hour variation in temperature. The only extensive work on this variation has been conducted by Pramanik [18], who concludes that the phase, ϕ_4, is fairly uniform with a slight seasonal variation from a mean of 204° in summer to 250° in winter. The mean annual amplitude, c_4, is a maximum (0.°23) at latitudes ±25° (approximately), decreasing to 0.°10 near the equator and to 0.°05 at latitudes ±50°. He found the amplitude smaller in summer than in winter and smaller at coastal stations than inland.

The irregularity of the Carnegie Fourier quantities for this 6-hour term precludes any detailed comparison with Pramanik's data. Figure 21, however, serves to indicate one conspicuous difference between the Carnegie values for c_4 and Pramanik's values for several stations in corresponding latitudes also under summer conditions [18, p. 55], that is, the small amplitude of the term from the Carnegie observations when compared with the large amplitude determined for these coastal stations by Pramanik.

CONCLUSION

The Carnegie data show that both spatial and time variations in air temperatures over the ocean are usually small. Owing to the slightness of such variations, however, it becomes increasingly evident that the accuracy of air-temperature measurements on board ship must be increased before detailed studies of these variations can be undertaken. Quite frequently the air temperatures recorded on the Carnegie show marked discrepancies, due, no doubt, to local heating and cooling of the vessel and thermometers; and, not many adequate temperature analyses could be made in view of the consequent inaccuracy of the data. It is to be hoped that greater attention will be given on future expeditions to the details of air-temperature measurement at sea, and that these Carnegie results may serve to stimulate investigation and experimentation in this field.

SEA-SURFACE TEMPERATURE

INSTRUMENTS AND METHODS

Sea-Water Thermograph

A continuous record of surface sea-water temperatures at a depth of approximately 2 meters below the surface was maintained by means of a mercury-in-steel bulb-and-capillary type sea-water thermograph with 24-hour movement (fig. 22). The recording apparatus for this instrument was located on a shelf in the chemical laboratory and communicated, through a lead capillary tube, with a large-volume mercury bulb in a protecting shield mounted on the hull of the vessel. The bulb was located 14.45 meters forward of the center of the rudder stock on the starboard side, 1.65 meters from the bottom of the keel by a vertical projection, and 1.71 meters out from the starboard edge of the keel. Under conditions of average draft, it was 2.29 meters below the sea surface. The thermometer bulb, itself, was 66 cm in length. Owing to the relatively small volume of mercury contained in the capillary tube as compared with the volume of mercury in the bulb, considerable changes of temperature in the chemical laboratory produced no apparent effect on the recorded sea-water temperatures. The traces were changed daily, usually at noon (GMT).

Canvas Bucket and Sea-Water Thermometer

In order to control the thermograph records, the temperature of the surface sea water was measured by the bucket method immediately before each change of thermogram at noon. This method consisted of lowering a canvas bucket into the water until the upper rim was about 60 cm beneath the surface, then quickly hauling the bucket to the deck, and measuring, with a sea-water thermometer, the temperature of the water contained. The canvas bucket was approximately 30 cm in depth by 15 cm in diameter. The thermometer (P.T.R. No. 373) was a standard instrument and needed no corrections throughout the ranges of sea temperature encountered on the cruise.

Very few adjustments of the thermograph were necessary, as the difference between bucket and thermograph readings remained practically constant from day to day. Occasionally, however, there appeared to be a slow but steady change in this difference owing to unknown causes, and therefore it became necessary to reset the recording pen of the thermograph on two or three occasions. In areas where the sea-surface temperatures were undergoing rapid changes, such as along the boundaries of well-developed ocean currents, or during calm, clear weather, these differences appeared to be somewhat erratic, owing probably to a lag in the recording mechanism of the thermograph. When the surface temperatures were changing rapidly, a mean of several bucket readings was used to determine the correction at that period.

Figure 23 shows two interesting thermograms from the cruise. The upper trace (A) was obtained on the western edge of the Coastal Peru Current and indicates rapid variations of as much as 2°.5 in about 10 minutes, presumably owing to the mixing of cold and warm water masses; the lower trace (B) shows the characteristic rapid changes of smaller amplitude recorded during calm, clear weather in the tropics.

Evaluation of Thermograms

The thermograms were scaled at each full hour, local mean time. The differences between the thermograph and bucket readings at noon (GMT) were determined as has been described, and these values were used as corrections to the hourly thermograph readings. It is realized that the probability of error in values obtained by the bucket method is greater than in the case of individual values obtained from the thermograms [30] therefore the corrections to be applied have been smoothed considerably, except in instances where it is evident that the differences were due to a shift in position of the thermogram on the drum or to rapid changes in sea-surface temperature. At the lowest sea temperatures, the bucket thermometer readings averaged from 0°.8 to 0°.9 higher than the thermograph temperatures, and at the maximum sea temperatures they averaged from 0°.1 to 0°.2 higher. Comparing sea-surface temperatures so obtained with those measured at each oceanographic station (fig. 1) with the reversing thermometers, it is found that no difference greater than 0°.5 occurred and at more than half of the stations this difference was less than 0°.1.

DISCUSSION

General Remarks

When it is considered that the heat capacity of sea water is 3300 times greater than that of dry air at standard pressure and temperature, it can readily be seen that the temperature of the sea surface controls, to a great extent, the temperature and vapor content of the overlying air. A knowledge of temperature conditions at the surface of the sea is therefore of fundamental importance to any study of marine meteorology.

For these reasons, the observation and recording of sea-surface temperature was made a part of the routine meteorological work on board the Carnegie, and, as a result, corrected hourly values of sea-surface temperature are available for 330 days during the cruise. All days when the vessel was in harbor have been omitted.

Mean Sea-Surface Temperatures for Groups

The hourly values of sea-surface temperature given in table 79 of appendix III have been summarized for the Groups outlined in table 1 and figure 3. These Groups were originally defined by Miss Clarke, and were constructed mainly on the basis of homogeneity of sea-surface temperature. Unfortunately, it is impossible to designate arbitrary geographical boundaries on the surface of a constantly moving and changing sea, and to expect the areas described by these boundaries to be true climatological entities throughout any given period. It has been necessary, however, to divide the data regionally in some manner for purposes of analysis, and it is believed that Miss Clarke's classification should serve this end. The hourly values corrected for noncyclic change, and the mean sea-surface temperatures for each

Group are given in table 31, without comment, inasmuch as no unusual or unexpected features appear to exist. Obviously, the mean sea-surface temperatures for the various groups are determined largely by season, latitude, area of the Group, and the relation of ocean currents to the greatest number of observations within the group.

Departures of Sea-Surface Temperatures from Normal Values

The mean values of sea-surface temperature for the various Groups have been compared with published tables and maps of sea-surface isotherms such as the Atlas of the Atlantic Ocean published by the Deutsche

Table 31. Mean hourly values of sea-surface temperature, in degrees centigrade, for groups, Carnegie, 1928-29

(Corrected for noncyclic change)

Groups	Dates	No. days	Mean		Local mean hours		
			Latitude	Longitude	0	1	2
	1928		°	°	°C	°C	°C
I	July 29-Aug. 6	9	56.3 N	40.7 W	10.33	10.41	10.47
II	Aug. 7-10	4	42.8 N	47.8 W	19.60	19.71	19.57
III	Aug. 11-Aug. 23	13	29.0 N	42.0 W	26.38	26.30	26.29
IV	Aug. 24-Sep. 15 [a]	21	11.8 N	43.0 W	27.43	27.43	27.41
V	Oct. 2-10	9	13.8 N	71.0 W	28.31	28.35	28.41
VI	Oct. 26-Nov. 6	12	4.0 N	81.0 W	26.52	26.53	26.50
VII							
(a)	Nov. 7-Dec. 21 [b]	35	16.5 S	104.3 W	21.65	21.63	21.63
(b)	Feb. 22-28, 1929	7	13.1 S	119.4 W	26.12	26.13	26.19
VIII	Dec. 22-31 [c]	8	37.2 S	96.7 W	17.36	17.32	17.21
	1929						
IX	Jan. 1-14	14	24.7 S	83.3 W	19.89	19.84	19.82
X	Feb. 6-17	12	12.3 S	88.2 W	23.81	23.84	23.85
XI	Mar. 1-31 [d]	21	16.8 S	147.9 W	28.22	28.23	28.20
XII	Apr. 22-May 31 [e]	32	9.7 N	168.7 E	27.42	27.44	27.37
XIII							
(a)	June 1-30 [f]	13	34.3 N	143.1 E	20.68	20.38	20.31
(b)	July 1-3	3	39.6 N	149.4 E	15.43	15.16	14.95
XIV	July 4-21 [g]	19	47.7 N	179.5 W	9.12	9.04	9.09
XV	July 22-28	7	41.5 N	131.8 W	14.57	14.56	14.63
XVI	Sep. 4-8	5	34.1 N	126.3 W	19.00	18.86	19.07
XVII							
(a)	Sep. 9-16	8	27.8 N	136.6 W	23.39	23.42	23.38
(b)	Sep. 17-Oct. 7 [h]	8	27.0 N	155.1 W	25.37	25.40	25.30
(c)	Oct. 11-25 [i]	14	25.2 N	140.7 W	23.60	23.66	23.62
XVIII	Oct. 26-Nov. 14	20	0.1 S	150.5 W	27.78	27.79	27.80

Groups	Local mean hours										
	3	4	5	6	7	8	9	10	11	12	13
	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C
I	10.46	10.44	10.36	10.38	10.28	10.23	10.31	10.47	10.57	10.64	10.69
II	19.38	19.09	18.83	18.66	18.87	18.81	18.49	18.40	18.69	18.32	18.83
III	26.28	26.21	26.19	26.20	26.23	26.21	26.26	26.33	26.39	26.42	26.44
IV	27.40	27.40	27.36	27.35	27.38	27.41	27.48	27.63	27.69	27.77	27.79
V	28.38	28.39	28.41	28.40	28.43	28.51	28.49	28.53	28.52	28.62	28.62
VI	26.48	26.52	26.52	26.52	26.56	26.58	26.64	26.65	26.66	26.66	26.64
VII											
(a)	21.63	21.65	21.68	21.70	21.69	21.69	21.70	21.77	21.84	21.92	21.95
(b)	26.19	26.18	26.19	26.27	26.26	26.24	26.23	26.23	26.22	26.24	26.29
VIII	17.18	17.23	17.23	17.22	17.39	17.44	17.60	17.58	17.65	17.69	17.69
IX	19.80	19.82	19.89	19.91	19.93	19.95	19.97	20.05	20.18	20.26	20.23
X	23.91	23.96	24.01	23.97	23.97	23.94	23.94	23.95	24.01	24.09	24.23
XI	28.27	28.22	28.18	28.15	28.10	28.11	28.15	28.22	28.27	28.39	28.52
XII	27.33	27.32	27.28	27.29	27.27	27.26	27.27	27.28	27.35	27.39	27.43
XIII											
(a)	20.26	20.31	20.37	20.42	20.47	20.50	20.34	20.09	20.28	20.52	20.54
(b)	15.01	15.14	15.19	15.48	15.44	15.60	15.70	15.02	15.01	15.30	15.42
XIV	9.02	9.04	9.03	9.02	9.00	8.91	8.96	8.97	8.96	8.97	9.05
XV	14.63	14.71	14.77	14.68	14.45	14.39	14.36	14.57	14.59	14.47	14.61
XVI	19.21	19.15	19.20	19.20	19.26	19.15	19.07	18.95	18.96	19.00	18.96
XVII											
(a)	23.33	23.43	23.36	23.32	23.38	23.30	23.23	23.25	23.30	23.37	23.42
(b)	25.33	25.35	25.33	25.32	25.38	25.41	25.42	25.49	25.52	25.58	25.57
(c)	23.72	23.75	23.69	23.70	23.73	23.74	23.67	23.63	23.65	23.69	23.75
XVIII	27.82	27.81	27.78	27.79	27.77	27.74	27.75	27.78	27.86	27.92	27.96

Table 31. Mean hourly values of sea-surface temperature, in degrees centigrade, for groups, Carnegie, 1928-29--Concluded

Group	Local mean hours										Mean
	14	15	16	17	18	19	20	21	22	23	
	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C
I	10.54	10.46	10.48	10.47	10.60	10.64	10.62	10.47	10.43	10.48	10.46
II	19.04	19.68	19.79	19.35	19.71	20.02	20.00	20.06	20.17	19.78	19.30
III	26.47	26.50	26.50	26.45	26.34	26.34	26.31	26.39	26.40	26.43	26.35
IV	27.93	27.96	27.88	27.81	27.72	27.66	27.58	27.56	27.52	27.44	27.58
V	28.66	28.59	28.56	28.42	28.47	28.38	28.35	28.30	28.30	28.32	28.44
VI	26.62	26.61	26.63	26.58	26.56	26.52	26.52	26.48	26.54	26.54	26.56
VII											
(a)	21.95	21.95	21.89	21.82	21.78	21.73	21.63	21.62	21.57	21.53	21.73
(b)	26.28	26.28	26.29	26.24	26.28	26.25	26.19	26.18	26.18	26.18	26.22
VIII	17.85	17.68	17.68	17.64	17.54	17.38	17.44	17.37	17.34	17.25	17.45
IX	20.24	20.27	20.14	19.88	20.01	19.85	19.97	19.86	19.85	19.85	19.97
X	24.08	24.09	24.13	24.22	24.11	24.04	23.98	23.93	23.88	23.82	23.98
XI	28.55	28.60	28.58	28.53	28.41	28.34	28.27	28.26	28.25	28.25	28.30
XII	27.51	27.48	27.48	27.47	27.47	27.44	27.41	27.39	27.41	27.41	27.38
XIII											
(a)	20.46	20.21	20.27	20.18	19.94	19.97	19.99	19.95	20.09	20.22	20.30
(b)	15.15	15.54	15.10	15.23	15.68	15.71	16.06	16.02	16.09	15.88	15.43
XIV	9.08	9.11	9.10	9.10	9.02	9.08	9.06	9.04	9.09	9.13	9.04
XV	14.75	14.94	15.14	15.22	15.35	15.25	14.75	14.87	14.73	14.64	14.73
XVI	18.95	18.97	19.01	18.88	18.82	18.56	18.65	18.67	18.81	18.84	18.97
XVII											
(a)	23.51	23.69	23.77	23.64	23.63	23.47	23.53	23.42	23.45	23.40	23.43
(b)	25.58	25.52	25.46	25.39	25.38	25.34	25.39	25.42	25.37	25.30	25.41
(c)	23.70	23.71	23.64	23.55	23.53	23.47	23.50	23.57	23.57	23.61	23.64
XVIII	28.01	28.01	27.99	27.92	27.85	27.81	27.80	27.77	27.76	27.75	27.83

Days omitted as follows: (a) Aug. 25, 26; (b) Dec. 3-12; (c) Dec. 25, 26; (d) Mar. 4, 13-20, 26; (e) May 6, 11, 20-25; (f) June 8-24; (g) Two dates July 14 on crossing 180° meridian; (h) Sep. 20-Oct. 2; (i) Oct. 18.

Seewarte, values for 5° squares published by the "Marine Observer," 1926, Pilot Charts of the Pacific and Atlantic oceans issued by the United States Hydrographic Office, Memoirs of the Imperial Marine Observatory, Japan, 1930, and Réseau Mondial (1925) values for 10° squares. Though the data from which these normal values of sea-surface temperature have been computed are meager, especially for parts of the Pacific Ocean, it is interesting to find that the Carnegie mean values for the various Groups and the values given for the approximate mean positions of these respective Groups in the publications cited seldom differ more than 1°. From this it can be inferred that temperatures of the ocean surface are remarkably uniform when compared with air temperatures. This reasoning, however, does not minimize the effect of persistent small differences in temperature on ocean currents, evaporation, air temperature, and stability.

Even the departures of individual observations of temperature from normal monthly values appear to be everywhere small, as may be shown by comparing the reversing-thermometer records of surface temperatures with monthly normals scaled from the isothermal charts of Schott and Schu [31].

From the simultaneity of change of surface temperature and salinity, Helland-Hansen [32] has concluded that unperiodic variations in sea-surface temperature must be chiefly the result of displacement of the surface layers. Although the series of Carnegie observations in such regions is short, the available data seem to bear out this conclusion; for example, the average areal sea-surface temperatures generally appear to depart from the normal temperatures by more than one degree only along the boundaries of ocean currents where shifting and mixing of water masses are taking place.

Maxima and Minima of Sea-Surface Temperature

The absolute maximum sea-surface temperature recorded during the cruise was 30°.2 and occurred at 14h and 15h, November 14, 1929, in latitude 11°.6 south, longitude 163°.4 west, while the vessel was approaching the Samoan Islands. The region around these islands was one of consistently high sea-surface temperatures during the two periods that the Carnegie spent in these waters (March-April and November 1929). A maximum temperature of 30°.0 was recorded at 14h, March 29, 1929, in latitude 15°.3 south, longitude 163°.3 west, and one of 29°.9 during 11h and 12h, April 26, 1929, in latitude 6°.7 south, longitude 172°.4 west. Sea-surface temperatures averaged above 29° throughout most of this part of the South Pacific Ocean.

Temperatures averaged considerably lower in the North Pacific Ocean; the absolute maximum was 28°.8. The highest sea-surface temperatures in the North Atlantic Ocean and Caribbean Sea were 29°.1 and 29°.2 respectively (see table 32).

The absolute minimum sea-surface temperature of the cruise (6°.4) was recorded in the North Pacific Ocean at noon on July 8, 1929, in latitude 46°.9 north, longitude 163° east. Average temperatures almost as low were recorded in the North Atlantic Ocean, but occurred in higher latitudes. The absolute minimum (6°.9) was recorded at 06h, July 14, 1928, in latitude 64°.1 north, longitude 11°.4 west. It may be remarked again that these

Table 32. Absolute maximum and minimum sea-surface temperatures by groups, Carnegie, 1928-29

Group	Absolute		Range
	Maximum	Minimum	
	°C	°C	°C
I	11.6	8.5	3.1
II	26.1	10.8	15.3
III	27.5	24.6	2.9
IV	29.1	26.2	2.9
V	29.2	27.9	1.3
VI	28.1	24.8	3.3
VII			
(a)	24.7	17.3	7.4
(b)	27.4	25.0	2.4
VIII	21.2	14.3	6.9
IX	22.1	13.8	8.3
X	27.4	21.1	6.3
XI	30.0	27.3	2.7
XII	29.9	23.4	6.5
XIII			
(a)	24.5	14.7	9.8
(b)	16.7	13.1	3.6
XIV	15.3	6.4[a]	8.9
XV	17.6	10.0	7.6
XVI	21.6	13.9	7.7
XVII			
(a)	25.2	21.4	3.8
(b)	27.1	23.3	3.8
(c)	26.4	21.8	4.6
XVIII	30.2[b]	26.3	3.9

[a] Absolute minimum sea-surface temperature of cruise.

[b] Absolute maximum sea-surface temperature of cruise.

extreme temperatures were all recorded in the open ocean, all harbor temperatures having been excluded.

As indicated in table 33, the mean daily maximum sea-surface temperature appears to be highest in the Caribbean Group. This condition is more apparent than real, for if the Christmas Island Group had been divided at some line south of the equator, without a doubt the southern portion would present as great an area with a higher mean maximum temperature.

Table 34 indicates that there is considerable variation in the time of occurrence of maximum and minimum mean sea-surface temperatures between the various Groups. This variability among Groups was even more pronounced than was found to be the case with air temperatures. The diurnal variation of sea-surface temperature is generally so small, however, that it is often masked by chance variations and by noncyclic differences. Nevertheless, the frequency distribution of hours of occurrence of maximum sea-surface temperatures indicates, very definitely, a maximum frequency of occurrence at 15h, two hours later than was shown by a similar treatment of air-temperature data (table 35).

This result agrees very well with the data assembled during the three cruises of the Snellius [24, p. 14], which show a maximum between 14h and 16h for each cruise.

An attempt was made to determine the frequency

Table 33. Mean daily maximum and minimum sea-surface temperatures by groups, Carnegie, 1928-29

Group	Maximum[c]	Minimum[c]	Daily range[c]
	°C	°C	°C
I	11.01	9.73	1.28
II	21.82	17.08	4.74[b]
III	26.74	25.93	0.81
IV	28.09	27.25	0.84
V	28.77[b]	28.08[b]	0.69
VI	26.86	26.28	0.58
VII			
(a)	22.70	21.15	1.55
(b)	26.43	25.96	0.47[a]
VIII	18.10	16.40	1.70
IX	20.76	19.26	1.50
X	24.50	23.37	1.13
XI	28.73	28.02	0.71
XII	27.75	27.08	0.67
XIII			
(a)	21.57	19.01	2.56
(b)	16.37	14.07	2.30
XIV	9.55[a]	8.61[a]	0.94
XV	15.79	13.29	2.50
XVI	19.70	17.88	1.82
XVII			
(a)	23.95	23.06	0.89
(b)	25.79	25.08	0.71
(c)	24.00	23.19	0.81
XVIII	28.16	27.48	0.68
Weighted mean	23.570	22.402	1.168

[a] Minimum value. [b] Maximum value. [c] Unperiodic.

Table 34. Mean maximum and minimum sea-surface temperatures and hours of occurrence for groups, Carnegie, 1928-29

Group	Maximum		Minimum	
	LMT	Mean temperature[a]	LMT	Mean temperature[a]
	h	°C	h	°C
I	13	10.69	8	10.23
II	22	20.17	12	18.32
III	15-16	26.50	5	26.19
IV	15	27.96	6	27.35
V	14	28.66	21-22	28.30
VI	11-12	26.66	3, 21	26.48
VII				
(a)	13-15	21.95	23	21.53
(b)	13, 16	26.29	1	26.13
VIII	14	17.85	3	17.18
IX	15	20.27	3	19.80
X	13	24.23	0	23.81
XI	15	28.60	7	28.10
XII	14	27.51	8	27.26
XIII				
(a)	13	20.54	18	19.94
(b)	22	16.09	2	14.95
XIV	23	9.13	8	8.91
XV	18	15.35	9	14.36
XVI	7	19.26	19	18.56
XVII				
(a)	16	23.77	9	23.23
(b)	12, 14	25.58	2, 23	25.30
(c)	4, 13	23.75	19	23.47
XVIII	14-15	28.01	8	27.74

[a] Periodic.

distribution of hours of minimum-temperature occurrence, but it was found that the data produced an almost complete scatter, with no concrete evidence that the minimum temperature tended to occur at any given hour between 17h and 09h. The explanation for this interesting result is obvious. As the surface layers of the sea cool by radiation to the sky, the surface particles become heavier than those particles immediately beneath the surface, and, as a result, a state of instability is produced. It may safely be assumed that as rapidly as the surface layers are cooled, they sink and are replaced by layers from below. The net result of such a mechanism would be to preserve a more or less uniform and stable sea-surface temperature for a considerable period. There is a slight indication that the maximum frequency occurs at 09h, but when it is considered that the frequencies at 03h, 04h, 05h, 06h, 07h, and 08h are respectively 52, 52, 51, 55, 50, 56, and 57 cases, it can readily be seen that such evidence is hardly conclusive. The most that can be said is that the minimum sea-surface temperature occurs most frequently between midnight and 09h.

The Snellius data [24], however, indicate that the minimum sea-surface temperature in equatorial regions tends to occur at 06h.

Diurnal Variation of Sea-Surface Temperature

General Remarks

Table 36 shows the small diurnal variation of sea-surface temperature over the ocean. From the frequencies of amplitude as computed from the Carnegie data, it can be stated that the apparent diurnal variation of sea-surface temperature is 1° or less, approximately 60 per cent of the time; between 1° and 2°, 28 per cent of the time; and over 2°, only 12 per cent of the time. Meinardus [33] found the corresponding values from the Gauss data to be 63, 23, and 14 per cent respectively. One may conclude from these data (666 days of observations) that on approximately 60 per cent of the days the diurnal variation of sea-surface temperature will be less than 1°, and that on about 85 per cent of the days it will not exceed 2°.

It is the belief of the writers, however, that these data are not conclusive, and that the actual diurnal variations of sea-surface temperature are somewhat less than the above values. An examination of the hourly sea-surface temperature data indicates that large diurnal variations in such temperatures are, in every case, the result of a change of water mass, for example, of the vessel's moving from warmer to colder water, or the contrary. Owing to such influences, it thus appears impossible to establish the amplitude of the diurnal variation of sea-surface temperature from the Carnegie data with any degree of certainty.

Variation of Sea-Surface Temperature for all Days

The mean hourly sea-surface temperatures, corrected for noncyclic change, are plotted in figure 24. These data appear to present a well-defined maximum at 15h, with a less well-defined minimum at 05h. It is

Table 35. Frequencies of hours of occurrence of maximum sea-surface temperature, Carnegie, 1928-29

Group	Local mean hours															
	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
I	...	...	...	...	...	...	2	2	2	1	2	3	1	2	1	...
II	...	...	...	...	...	...	...	...	...	...	...	2	1	1	...	1
III	...	...	...	...	...	...	...	2	3	3	4	4	3	1	...	...
IV	...	...	...	...	...	1	2	1	3	8	11	5	2	1	...	...
V	...	...	1	1	...	1	2	2	4	4	2	1	1	...	...	1
VI	2	2	4	6	6	4	4	2	1	1	2	...	...	...	...	...
VII																
(a)	1	3	...	1	1	2	6	7	9	8	7	6	3	4	6	2
(b)	...	1	...	...	...	...	...	1	2	2	2	3	3	3	3	1
VIII	...	...	...	...	1	1	1	...	...	2	1	2	1	1	1	1
IX	2	1	2	2	1	1	2	2	2	4	4	4	3	3	3	1
X	...	...	...	...	...	...	1	2	1	1	2	4	4	2	1	2
XI	1	1	...	...	...	...	1	...	3	4	6	5	3	2	3	1
XII	1	2	2	1	2	1	3	2	4	11	10	9	5	3	4	3
XIII																
(a)	1	1	...	...	...	...	...	...	...	1	1	...	4	3	2	2
(b)	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...
XIV	...	2	2	...	1	...	...	1	1	3	1	1	3	1	1	2
XV	...	...	...	...	...	...	...	...	...	...	1	1	2	2	2	2
XVI	...	...	...	...	...	...	...	1	1	...	...	...	...	1	...	1
XVII																
(a)	...	...	1	...	...	...	...	...	...	1	3	4	2	3	1	...
(b)	...	...	2	2	1	2	2	2	2	1	1	...	...	...	...	...
(c)	1	1	1	1	1	1	1	1	2	4	3	3	...	...	1	1
XVIII	1	1	1	2	2	3	3	5	7	11	9	9	7	3	4	4
Total	10	15	16	16	16	17	30	33	47	70	73	66	48	36	33	25

Table 36. Frequency in days of unperiodic daily amplitude of sea-surface temperature, Carnegie, 1928-29, and on Gauss, 1901-03

Vessel	Amplitude in °C						Total days
	<0.5	0.5-1.0	1.0-1.5	1.5-2.0	2.0-3.0	>3.0	
Carnegie	55	142	66	26	25	16	330
Gauss	104	109	54	24	30	15	336

Table 37. Diurnal amplitude of sea-surface temperature according to ranges in latitude, Carnegie, 1928-29

Range in latitude	Diurnal amplitude	Range in latitude	Diurnal amplitude
° °	°C	° °	°C
>45 N	1.2	5 N- 5 S	1.0
45 N-35 N	2.3	5 S-15 S	0.9
35 N-25 N	1.2	15 S-25 S	0.7
25 N-15 N	0.8	25 S-35 S	1.1
15 N- 5 N	0.7	35 S-45 S	1.6
Mean	....	.....	1.15

interesting to consider that the minima for sea-surface and air temperature occur at the same hour, but that there is a lag of two hours in the sea-surface maximum.

Variation of the Diurnal Amplitude of Sea-Surface Temperature with Latitude

Table 37 shows the variation in the daily range of sea-surface temperature with latitude. It appears that the amplitude generally increases with latitude, although it may be noted that the amplitude is somewhat greater at the equator than between latitudes ±5° to ±25°, and that the amplitude at mean latitude 40° north is unusually large. The explanation for the maximum at the equator appears to be that the amplitude within the range of latitude ±5° is greatly influenced by the number of observations made on board the Carnegie in the vicinity of the Galápagos Islands, where noncyclic changes in sea-surface temperatures were large. Similarly, the amplitude between latitudes 35° and 45° north appears to have been greatly affected by observations made within the California and Kuroshio currents, where, again, noncyclic effects were important. The curve produced by the data in table 37 would probably be more regular if more data were used in computing the means.

The elimination of all days with a range of sea-surface temperature greater than 3°, however, does not appreciably affect the results.

Effect of the State of the Sea on the Diurnal Variation of Sea-Surface Temperature

Since mixing of the surface sea waters should tend to reduce the daily amplitude of sea-surface temperatures, a comparison of the differences between the unperiodic amplitude for days with moderate-to-rough sea and for days with a smooth sea has been made for the purpose of determining to what extent this is true.

Owing to the loss of the logbook of the Carnegie, it has been possible definitely to select days with a smooth or rough sea in only thirty-four cases. All these were days when the vessel was in tropical waters between latitudes ±20°. The results give a value of 0°.6 for the seventeen days with moderate-to-rough sea, and 1°.4 for the seventeen days with smooth sea. Although it is realized that seventeen days of observation are not sufficient to determine this relationship satisfactorily, it is believed that the difference between the two sets of data (0°.8) is sufficiently large to be conclusive.

Van Riel [34] found that the change in the state of the sea from mean smooth to mean moderate reduced the daily range in temperature about 0°.2. Information concerning the methods of determining the state of the sea for Van Riel's data is not given, but it is assumed that these data were probably more accurate than the corresponding Carnegie data, and thus that his range is most nearly correct.

Effect of Cloudiness on the Diurnal Variation of Sea-Surface Temperature

It was considered especially interesting to observe the effect of cloudiness on the diurnal variation of sea-surface temperature, but, again, the loss of the Carnegie logbook makes it difficult to separate the days into appropriate groups. Ten days have been chosen, however, which were summarized in the log abstract as "clear days" (cloudiness less than 0.2) with wind force less than 4, Beaufort scale, and also ten cloudy days (cloudiness greater than 0.8) with wind force less than 4. These twenty days were all in the tropical Pacific Ocean between latitudes ±20°.

The mean daily range of temperature for the ten cloudy days proves to be 0°.66, and for the ten clear days, 1°.24. These values compare favorably with those determined by Schott [35] from observations on a sailing vessel and by Meinardus [4, p. 522] from the Gauss data (table 38).

The mean 24-hour values, corrected for noncyclic change, were computed for each of the above ten-day groups and the results are shown in figure 25. The small periodic amplitude of 0°.1 for the cloudy days is in decided contrast with the amplitude of 0°.8 for the clear days. According to these curves, the minimum sea-surface temperature occurs at 07h on the clear days, and on the cloudy days at 02h. The maximum sea-

surface temperature on the clear days occurs at 15h, and on the cloudy days at 17h and 18h.

Effect of Wind on the Diurnal Variation of Sea-Surface Temperature

In a similar manner, the mean unperiodic amplitude has been computed for days with various wind velocities. In the abstracts of the ship's log, the wind force was usually given more explicitly than the cloudiness. Therefore, it has not been difficult to select fifty-four days in tropical regions with an average wind force equal to or greater than 4 on the Beaufort scale, and forty-six days within the same latitudes with wind force less than 4. These selections were made without regard to other meteorological conditions. The results give an amplitude of 0°.65 for days with a wind force equal to or greater than 4, and one of 1°.03 for days with wind force less than this value.

The mean diurnal courses of sea-surface temperature for these same groups were computed, corrected for noncyclic change, and the resulting curves are shown in figure 25. The periodic amplitude on windy days amounts to 0°.11, and on relatively calm days to 0°.84. The maximum of the mean sea-surface temperature for windy days falls at 15h and the minimum at 07h. On calm days, the maximum occurs at 13h, and the minimum at 23h.

From these data we can conclude that wind, rough sea, and cloudiness are conducive to small diurnal ranges in sea-surface temperature. The reasons appear obvious.

Harmonic Analysis of Sea-Temperature Data

A more detailed study of the diurnal variation of sea-surface temperature is possible from an examination of the results of Fourier analyses of the mean diurnal curves for each of the groups of Carnegie data. From the mean hourly departures, the Fourier coefficients for the 24-hour, 12-hour, 8-hour, and 6-hour terms have been determined and the results given in table 39.

The amplitudes and phase angles, used as polar coordinates, were plotted on harmonic dials to facilitate study. It was immediately obvious from a preliminary examination of these figures that the coefficients for Groups II, XIIIa, XIIIb, and XV were extremely irregular, falling completely out of phase with the greater number of diurnal curves, and exhibiting amplitudes much larger than average. The reasons for these irregularities are not difficult to explain; namely, Group II includes four days in the region of the Gulf Stream where the diurnal variability of sea-surface temperature is no doubt completely obscured by noncyclic changes; Group XIIIa and Group XIIIb include sixteen days of observation in the Kuroshio Current, where the mean is affected by rapid mixing of water masses of very different temperatures; and Group XV embraces five days of changeable temperatures due to the crossing of the California Current where, again, the diurnal variations are masked by the large unperiodic variations.

For these reasons, the above-mentioned Groups will not be considered in this discussion.

Table 38. Mean unperiodic daily amplitude of sea-surface temperature, tropical latitudes, clear days and cloudy days, wind force less than 4 Beaufort Scale, Carnegie and Gauss and after Schott

Source	Cloudy days		Clear days	
	Amplitude	Days	Amplitude	Days
	°C		°C	
Carnegie	0.66	10	1.24	10
Gauss	0.88	28	1.02	19
Schott	0.93	?	1.59	?
Mean	0.82	...	1.28	...

According to values derived for ϕ_1, the maximum sea-surface temperature, c_1, occurs between noon and 17h except for Groups XVI and XVIIc, which show maxima in the morning, Presumably these two Groups were also affected to some extent by large regional variations in temperature. By averaging the Fourier coefficients, a_1 and b_1, for the remaining sixteen Groups, it is found that the mean amplitude and phase angle are 0°.12 and 228° respectively. In other words a mean maximum amplitude of 0°.12 occurs on the average at 14h 48m.

The Carnegie amplitudes and phase angles of the 24-hour and 12-hour terms have been compared with values for these terms derived from Gauss and Challenger [4, p. 509, table 95a] observations in corresponding latitudes and the results are presented in table 40. The Carnegie amplitudes average somewhat lower than the Gauss values, in all probability because of differences in observational methods. The mean amplitude of the Carnegie, Gauss, and Challenger 24-hour term is practically the same but the first crest of the double diurnal oscillation occurs, according to the Carnegie data, at 02h 06m, or approximately three-quarters of an hour later than is indicated by the Gauss and Challenger data (01h 16m and 01h 24m, respectively).

Sea and Air Temperatures

General Remarks

It is obvious that the direct thermal influence of the air on surface sea waters is small as a result of the low specific heat of air. Probably for this reason, among others, the relations between sea and air temperatures have not been given adequate attention by oceanographers. On the other hand, the direct effect of sea-surface temperatures on the temperature of the air immediately above the surface is powerful and important. For this reason, a knowledge of the differences between sea and air temperatures is of extreme importance to the meteorologist, and a study of these differences is essential in any consideration of the thermodynamical properties of maritime air masses. In view of the importance of such a study, the relation between sea and air temperatures will be considered in detail.

Table 39. Results of Fourier analyses of mean diurnal variation of sea-surface temperature for groups, Carnegie, 1928-29

Group	Coefficients							
	a_1	a_2	a_3	a_4	b_1	b_2	b_3	b_4
	°C	°C	°C	°C	°C	°°C	°C	°C
I	-.038	+.033	-.098	+.034	-.098	+.022	+.027	+.014
II	+.519	-.060	+.065	-.139	-.519	+.031	-.038	+.066
III	-.038	+.058	+.014	-.007	-.104	+.025	-.019	-.021
IV	-.169	+.031	.000	-.018	-.185	+.069	-.002	-.009
V	-.135	+.023	+.002	-.004	-.003	+.047	-.003	+.022
VI	-.072	+.027	+.013	+.004	-.005	-.003	+.005	-.013
VII								
(a)	-.148	+.014	-.005	+.015	-.048	+.063	-.006	+.009
(b)	-.052	-.027	+.003	.000	-.015	+.009	-.010	+.009
VIII	-.220	+.049	+.033	-.009	-.118	+.011	+.002	-.001
IX	-.179	+.060	-.010	+.008	-.054	+.035	-.038	+.011
X	-.111	-.046	-.027	+.022	-.064	+.049	-.006	-.005
XI	-.087	+.018	+.001	-.009	-.148	+.105	-.017	-.013
XII	+.002	+.021	+.008	+.010	-.092	+.040	+.006	+.008
XIII								
(a)	-.052	+.105	+.068	+.090	+.169	+.083	-.079	+.050
(b)	+.131	-.076	-.003	-.028	-.194	-.307	-.177	+.066
XIV	+.037	+.008	+.013	+.002	-.045	+.033	-.021	-.009
XV	+.020	-.183	-.016	+.035	-.270	+.098	+.050	-.072
XVI	-.046	-.022	+.048	+.001	+.208	+.090	-.030	-.026
XVII								
(a)	-.003	-.051	+.037	-.007	-.141	+.086	-.021	-.011
(b)	-.095	+.050	-.013	-.008	-.029	+.009	-.015	+.013
(c)	-.039	+.017	+.006	-.015	+.076	+.042	-.035	+.004
XVIII	-.068	+.012	-.002	-.002	-.056	+.074	-.015	.000

Group	Amplitudes				Phase angles			
	c_1	c_2	c_3	c_4	ϕ_1	ϕ_2	ϕ_3	ϕ_4
	°C	°C	°C	°C	°C	°C	°C	°C
I	.105	.040	.102	.037	201.2	56.3	285.4	67.6
II	.734	.068	.075	.154	135.0	297.3	120.3	295.4
III	.111	.063	.024	.022	200.1	66.7	143.6	198.4
IV	.251	.076	.002	.020	222.4	24.2	180.0	243.4
V	.135	.052	.004	.022	268.7	26.1	146.3	349.7
VI	.072	.027	.014	.014	266.0	96.4	69.0	162.9
VII								
(a)	.156	.065	.008	.017	252.0	12.5	219.8	59.0
(b)	.054	.029	.010	.009	253.9	288.4	163.3	360.0
VIII	.250	.050	.033	.009	241.8	77.3	86.5	263.7
IX	.187	.070	.039	.014	253.2	59.7	194.7	36.0
X	.128	.067	.028	.023	240.0	316.8	257.5	102.8
XI	.172	.107	.017	.016	210.4	9.7	176.6	214.7
XII	.092	.045	.010	.013	178.8	27.7	126.9	51.3
XIII								
(a)	.177	.134	.104	.103	342.9	51.7	139.3	60.9
(b)	.234	.316	.177	.072	146.0	193.9	181.0	337.0
XIV	.058	.034	.025	.009	140.6	13.6	148.2	167.5
XV	.271	.208	.052	.080	175.8	298.2	342.3	154.1
XVI	.213	.093	.057	.026	347.5	346.3	122.0	177.8
XVII								
(a)	.141	.100	.043	.013	183.2	329.3	119.6	212.5
(b)	.099	.051	.020	.015	253.0	79.8	220.9	328.4
(c)	.085	.045	.035	.015	332.8	22.0	170.3	284.9
XVIII	.088	.075	.015	.002	230.5	9.2	187.6	270.0

Sea- and Air-Temperature Differences

A comparison of the daily means of sea and air temperatures, as obtained on the Carnegie, attests to the well-known fact that the sea surface is generally warmer than the air during summer months. From the daily means of the entire cruise it was found that the mean sea-surface temperatures exceeded the mean air temperatures on 61.5 per cent of all days. Helland-Hansen obtained similar results from data compiled during two summer months in the North Atlantic [32, p. 9]. He found that the mean sea temperature exceeded the mean air temperature on 68 per cent of the days of observation. Moreover, his mean air temperatures were not corrected for overheating of the thermometers during daylight hours, and are undoubtedly too high fairly to represent air temperatures at similar heights above the sea surface.

Table 40. Amplitudes and phase angles of diurnal and semidiurnal oscillations of sea-surface temperature from observations on Carnegie, Gauss, and Challenger

(Carnegie groups II, XIV, XV, XVII, XVIII, and XXI omitted; See Ad. Schmidt)

Range in latitude	Carnegie					Gauss					Challenger				
	Amplitude		Phase angle		No. days	Amplitude		Phase angle		No. days	Amplitude		Phase angle		No. days
	c_1	c_2	ϕ_1	ϕ_2		c_1	c_2	ϕ_1	ϕ_2		c_1	c_2	ϕ_1	ϕ_2	
° °	°	°	°	°		°	°	°	°		°	°	°	°	°
35 N-15 N	0.11	0.06	200	67	13[a]	0.22	0.13	243	21	31[a]	.....	.....	.....	.....	.....
15 N- 5 N	0.18	0.06	302	25	30[a]	0.31	0.13	230	66	14[a]	.....	.....	.....	.....	.....
5 S-25 S	0.12	0.05	241	0	121[b]	0.18	0.04	237	50	52[a]	.....	.....	.....	.....	.....
All latitudes	0.12	0.04	228	27	248[c]	0.17	0.06	225	52	201[d]	0.19	0.03	226	48	651[e]

[a] Atlantic Ocean. [b] Pacific Ocean. [c] Atlantic and Pacific oceans. [d] Atlantic and Indian oceans. [e] All oceans.

It should be remarked that the investigations carried out on board the Carnegie took place either in the tropics or during the summer months in higher latitudes. Thus all observational work was done under conditions where such temperature relations would be expected, and for this reason the results given in this section are not presented as being wholly representative of average conditions throughout the year.

The difference between mean sea and air temperatures on the Carnegie was never as great as 2°.0. In only two areas, the Gulf Stream and the Gulf of Panama, were mean sea-surface temperatures more than 1°.0 higher than mean air temperatures. A maximum mean difference of 1°.6 was recorded within the Gulf Stream, as might be expected in view of the high water temperatures of the current and its comparative narrowness. A difference of 1°.5 between mean sea and air temperatures in the Gulf of Panama may be explained by the fact that during the entire twelve days of this series, the wind was consistently from the southwest--from a region in which sea-surface temperatures only a few hundred miles away were as much as 8° lower than in the Gulf. Thus, air considerably colder than Gulf water was constantly being imported.

It is also interesting to note that of the means for the Groups which include that part of the cruise from Japan to San Francisco, those for air temperature appear to have been slightly higher than those for sea-surface temperature. Differences were small: from 0°.1 to 0°.7. The winds usually had a southerly component during this part of the cruise. It may be assumed that air masses were Tp (Tropical Pacific), or at least greatly modified Npp (Transitional Polar Pacific).

In one other area, that centered off the coast of Chile approximately on the western edge of the Peruvian Current, the mean air temperature was 0°.11 higher than the rather low mean sea-surface temperature.

As shown by Visser [24, p. 12] and Braak [36], sea-surface temperatures in the tropics are usually higher than air temperatures, throughout all months of the year. Visser noted a difference of +0°.84 as the mean for all months during the three cruises of the Snellius (1929-1930) in the Netherlands East Indies; and Braak, on his voyage between Batavia and Ambon, found a mean difference of +1°.05.

Table 41. Variation with latitude of mean difference between temperatures of sea and air, Carnegie, 1928-29

Range in latitude	Mean sea - air	Range in latitude	Mean sea - air
° °	°C	° °	°C
> 45 N	+0.97	5 N- 5 S	+0.43
45 N-35 N	-0.23	5 S-15 S	+0.14
35 N-25 N	+0.24	15 S-25 S	+0.34
25 N-15 N	+0.13	25 S-15 S	+0.21
15 N- 5 N	+0.50	35 S-45 S	-0.16
Mean		.....	+0.256

Variation of Sea-Surface and Air-Temperature Differences with Latitude

As indicated in figure 14, the mean sea-surface temperature exceeds the mean air temperature throughout all ranges of latitude except between latitudes ±35° to ±45°. Apparently these two ranges mark the discontinuity between the warm southern and cool northern waters.

It may be noted that the mean sea-surface temperature for all days (21°.93) is exceeded by the mean air temperature for all days (22°.70). This condition may be explained by the fact that the recording of sea-surface temperature began shortly after the Carnegie left Hampton Roads, whereas the recording of air temperature did not begin until after the Carnegie left Hamburg. Therefore, the mean values for all days are not comparable, in that the Carnegie mean sea-surface temperature for all days is affected by the greater number of observations in the higher latitudes (35° to 45° north).

The mean difference, however, between sea-surface and air temperatures (sea minus air) for all ranges of latitude is +0°.256.

Diurnal Variation of Sea- and Air-Temperature Differences

From the corrected hourly means of sea and air temperatures for the various Groups, a study of the diurnal variation of the temperature differences has been made. From the literature concerning previous investigations along this line, it was expected that the diurnal

Table 42. Diurnal variation of weighted means and differences between temperatures of sea and air (uncorrected) in groups I to VII(a), Carnegie, 1928-29

Group	No. days	Local mean hours											
		0	1	2	3	4	5	6	7	8	9	10	11
		°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C
I	9	+0.66	+0.75	+0.87	+0.91	+0.85	+0.80	+0.88	+0.69	+0.59	+0.40	+0.06	+0.02
II	4	+1.88	+2.06	+1.98	+1.84	+1.65	+1.39	+1.53	+1.68	+1.55	+0.83	+0.49	+0.54
III	13	+0.49	+0.47	+0.45	+0.46	+0.38	+0.38	+0.45	+0.45	+0.18	+0.10	-0.29	-0.54
IV	21	+0.86	+0.93	+0.95	+0.96	+0.92	+0.86	+0.74	+0.54	+0.11	-0.30	-0.68	-0.91
V	9	+0.43	+0.47	+0.54	+0.69	+0.68	+0.68	+0.43	+0.18	-0.02	-0.18	+0.03	-0.07
VI	12	+1.35	+1.47	+1.51	+1.39	+1.42	+1.44	+1.57	+1.50	+1.35	+1.35	+1.24	+1.24
VII (a)	35	+0.77	+0.83	+0.81	+0.81	+0.89	+0.88	+0.73	+0.48	+0.25	+0.01	+0.15	-0.17
Total	103	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Weighted means		+0.82	+0.89	+0.90	+0.90	+0.90	+0.87	+0.81	+0.65	+0.40	+0.16	-0.05	-0.15

Group	Local mean hours												Mean
	12	13	14	15	16	17	18	19	20	21	22	23	
	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C
I	-0.05	+0.00	-0.19	-0.24	-0.29	-0.13	+0.05	+0.40	+0.59	+0.54	+0.56	+0.76	+0.40
II	-0.11	+0.46	+0.65	+1.14	+1.20	+0.84	+1.09	+1.81	+2.12	+2.35	+2.29	+1.88	+1.38
III	-0.80	-0.87	-0.80	-0.74	-0.71	-0.50	-0.27	+0.09	+0.21	+0.40	+0.33	+0.48	+0.01
IV	-0.73	-0.71	-0.51	-0.29	+0.08	+0.29	+0.51	+0.61	+0.71	+0.72	+0.73	+0.79	+0.30
V	-0.29	-0.32	-0.38	-0.20	+0.04	+0.48	+0.60	+0.54	+0.64	+0.60	+0.60	+0.42	+0.27
VI	+0.94	+0.80	+0.85	+0.88	+0.85	+1.06	+1.29	+1.41	+1.41	+1.33	+1.41	+1.36	+1.27
VII (a)	-0.18	-0.18	-0.13	+0.14	+0.24	+0.36	+0.54	+0.62	+0.59	+0.66	+0.61	+0.64	+0.42
Weighted means	-0.24	-0.23	-0.17	-0.09	+0.13	+0.30	+0.50	+0.66	+0.73	+0.77	+0.75	+0.77	+0.47

variation in differences between sea-surface and air temperatures would be small -- about 1° -- and that in general, air temperatures would be lower than sea temperatures during the night, and would approach and probably exceed sea temperatures during the day. An examination of table 42 indicates that such a condition definitely obtains where air-temperature data have not been corrected for radiational effects. As shown in figure 27, however, no such simple relationship appears to exist in the case of air-temperature data which have been corrected for excessive heating during daylight hours. These data show that the sea-surface temperature (under average summer conditions) tends to be higher than the air temperature throughout the entire 24-hour period, but that this difference is at a maximum from 01h to 06h, and at a minimum at 09h. On first consideration it might be assumed that the minimum difference should occur between 12h and 13h, when the air temperature is at a maximum. It may be explained, however, that air temperatures on board the Carnegie were obtained at a height of 3.7 meters above the sea surface, whereas sea-surface temperatures were measured at a depth of 2 meters. The surface air undoubtedly heats more rapidly after sunrise than does the surface sea water at a depth of 2 meters. We may speculate on the possibility that such an effect might produce the minimum difference at 09h indicated by the data plotted in figure 27.

The maximum difference noted during the early morning hours probably would be less pronounced if the air-temperature data could be corrected for errors arising through excessive cooling of deck, shelter, and thermal elements by radiation at night.

Data concerning the diurnal variation of sea- and air-temperature differences for Groups I to XI are presented in table 43, which indicates that mean sea-surface temperatures exceed mean air temperatures in all Groups except in the Southwest Juan Fernandez Island Group. As stated by Miss Clarke [23, p. 184].

"For the groups which include that part of the cruise from Iceland to the Central North Atlantic (17° north, 38° west) and from Barbados to Callao, none of the 24 mean hourly air temperatures exceeded the mean hourly sea temperatures. For all other groups the mean hourly air temperature at some time during the day rose higher than the mean sea temperatures. However, when air temperatures not corrected for radiation were used in this comparison, for every Group except that of the Gulf Stream and of the Gulf of Panama, air temperatures exceeded sea temperatures sometime during the day. This seems to indicate that if the effect of radiation could be eliminated, the mean daily air temperature would seldom exceed mean daily sea temperature."

After the mean curves of sea and air temperature had been plotted for all groups, two distinct types of diurnal curves were recognized. In one type the air temperature exceeds the sea temperature only during the forenoon from 08h to noon. In others, the air temperature rises above the sea temperature about 08h or 09h and remains above it until late afternoon. Two representative curves of these types are shown in figure 17. A study of the cause of this variation revealed that in

Table 43. Diurnal variation of weighted means and differences between temperatures of sea (corrected for noncyclic change) and air (corrected for noncyclic change and for radiation) in groups I to XI, Carnegie, 1928-29

Group	No. days	Local mean hours											
		0	1	2	3	4	5	6	7	8	9	10	11
		°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C
I	9	+0.66	+0.75	+0.87	+0.91	+0.85	+0.80	+0.88	+0.69	+0.59	+0.40	+0.13	+0.19
II	4	+1.88	+2.06	+1.98	+1.84	+1.65	+1.39	+1.53	+1.68	+1.55	+0.83	+0.65	+0.91
III	13	+0.49	+0.47	+0.45	+0.46	+0.38	+0.38	+0.45	+0.45	+0.17	+0.13	+0.18	+0.28
IV	21	+0.86	+0.93	+0.96	+0.96	+0.92	+0.86	+0.74	+0.54	+0.11	-0.23	-0.05	+0.05
V	9	+0.43	+0.47	+0.54	+0.69	+0.68	+0.68	+0.43	+0.18	-0.02	+0.10	+0.45	+0.42
VI	12	+1.35	+1.47	+1.51	+1.39	+1.42	+1.45	+1.57	+1.61	+1.64	+1.72	+1.74	+1.86
VII													
(a)	35	+0.77	+0.83	+0.81	+0.81	+0.89	+0.88	+0.73	+0.48	+0.25	+0.03	+0.06	+0.18
(b)	8	+0.32	+0.39	+0.35	+0.29	+0.31	+0.25	+0.09	+0.26	±0.00	+0.12	+0.25	+0.12
VIII	14	+0.03	+0.33	+0.30	+0.29	+0.35	+0.41	+0.13	-0.13	-0.17	-0.28	-0.39	-0.36
IX	12	+0.29	+0.49	+0.45	+0.48	+0.49	+0.60	+0.43	+0.25	+0.06	-0.09	-0.11	+0.01
X	7	+0.41	+0.48	+0.62	+0.61	+0.57	+0.55	+0.64	+0.47	+0.01	-0.14	-0.12	-0.11
XI	21	+0.65	+0.97	+0.89	+0.91	+0.89	+0.93	+0.93	+0.47	+0.04	-0.23	-0.28	-0.13
Total	165	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Weighted means	.....	+0.67	+0.78	+0.78	+0.78	+0.78	+0.77	+0.70	+0.51	+0.26	+0.10	+0.13	+0.21

Group	Local mean hours												Mean
	12	13	14	15	16	17	18	19	20	21	22	23	
	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C
I	+0.25	+0.42	+0.32	+0.30	+0.24	+0.35	+0.45	+0.66	+0.70	+0.54	+0.56	+0.76	+0.55
II	+0.43	+1.15	+1.40	+1.91	+1.94	+1.48	+1.60	+2.18	+2.30	+2.38	+2.29	+1.88	+1.62
III	+0.16	+0.12	+0.13	+0.04	-0.03	+0.01	+0.04	+0.16	+0.21	+0.40	+0.33	+0.48	+0.26
IV	+0.28	+0.19	+0.23	+0.25	+0.46	+0.57	+0.70	+0.71	+0.71	+0.72	+0.72	+0.79	+0.54
V	+0.23	+0.16	±0.00	-0.01	+0.06	+0.48	+0.60	+0.64	+0.64	+0.60	+0.60	+0.42	+0.39
VI	+1.60	+1.44	+1.43	+1.34	+1.14	+1.22	+1.34	+1.40	+1.41	+1.35	+1.41	+1.36	+1.51
VII													
(a)	+0.28	+0.31	+0.28	+0.40	+0.40	+0.47	+0.63	+0.63	+0.59	+0.66	+0.61	+0.64	+0.53
(b)	+0.09	-0.03	+0.28	+0.08	-0.08	-0.10	+0.06	+0.05	+0.22	+0.17	+0.28	+0.26	+0.17
VIII	-0.20	-0.26	-0.59	-0.60	-0.73	-0.91	-0.60	-0.37	+0.08	+0.06	+0.14	+0.20	-0.13
IX	+0.01	+0.24	+0.07	-0.07	+0.04	+0.04	+0.08	+0.31	+0.33	+0.32	+0.37	+0.35	+0.22
X	-0.04	-0.02	-0.04	+0.03	+0.11	-0.01	+0.04	+0.18	+0.18	+0.26	+0.28	+0.30	+0.22
XI	+0.03	+0.24	+0.40	+0.60	+0.70	+0.51	+0.54	+0.75	+0.72	+0.68	+0.82	+0.84	+0.54
Weighted means	+0.25	+0.29	+0.26	+0.30	+0.32	+0.33	+0.45	+0.56	+0.60	+0.61	+0.63	+0.66	+0.49

the Groups in which the air temperature was greater than the sea temperature in the morning, and then fell below for the rest of the day, the air temperature was at a maximum about 10h. The most plausible explanation for this seems to be found in the records of cloudiness from the log abstract and from records during atmospheric-electric observations, which indicate that days included in means which had an early maximum were also days when the sky became cloudy during the late morning and remained cloudy the rest of the day, thus producing an effect comparable with that of a mountain climate in summer.

Regional Variations in Sea-Surface Temperatures

General Remarks

Sea-surface temperatures over the greater part of the ocean, in general, are remarkably uniform from day to day, and rapid spatial temperature changes appear to occur only along the boundaries of well-developed ocean currents where displacements of large water masses are taking place. Thus we may assume that any zone which presents a complicated pattern of isotherms bounds a region within which significant water transport is occurring. It was hoped that by plotting isothermal maps, using the Carnegie sea-surface temperature data, it would be possible to show those general regions where such transport was taking place, and, by observing the regions where the concentration of isotherms was at a maximum, accurately to define the boundaries of the more important ocean currents. Unfortunately, the original logbook of the Carnegie was lost, and it is impossible definitely to place rapid temperature changes shown by the data, with respect either to geographical position or the horizontal distance over which the given change took place (dt/ds). It is believed, however, that the data will show those general regions wherein temperature gradients are steep, although the exact slope and location in each case must remain in doubt.

Variation of Sea-Surface Temperature with Latitude

If the sea were a more or less stationary fluid body, we should expect the mean sea-surface temperatures averaged throughout the year to be at a maximum near the equator and to fall off gradually toward the poles. As

indicated in figure 14, however, the sea-temperature data appear to present two maxima, one between latitudes 5° and 15° north, and another, less pronounced, between latitudes 5° and 15° south. Thus the effect of ocean currents on mean sea-surface temperatures immediately becomes evident. The minimum at the equator is no doubt emphasized by the fact that many of the Carnegie sea-temperature data between latitudes ±5° were collected in the vicinity of the Galápagos Islands where sea-surface temperatures are abnormally low because of the importation of cold southern waters by the Southern Equatorial Counter Current.

An examination of figure 14 reveals the fact that the sea- and air-temperature curves follow each other very closely for all latitudes.

Sea-Surface Temperatures in the North Atlantic Ocean

Sea-surface isotherms for the North Atlantic, constructed from the Carnegie hourly sea-temperature data, have been plotted in figure 28 for the purpose of illustrating the horizontal distribution of sea-surface temperatures over this region. An examination of this figure reveals that there are five general Zones within which the concentration of isotherms is at a maximum. The first (I) occurs south of Iceland, approximately in latitude 65° north, and between longitudes 10° and 24° west. This is a region where considerable mixing of northern and southern waters is taking place, and thus we would expect it to be also a region presenting a rather wide range of sea-surface temperature.

The greatest concentration of isotherms in the North Atlantic (II) occurs off the east coast of Newfoundland and Nova Scotia in longitude 48° west, where the Carnegie passed from the cold Labrador Current into the warmer waters of the Gulf Stream. During one part of this transition, the sea-surface temperature rose 7°.5 in approximately one degree of latitude.

Zones III and IV present some slight temperature irregularities, and were no doubt located on the boundary between the Gulf Stream and the Sargasso Sea.

Zone V (latitude 14° north, longitude 38° west) appears to be within the Atlantic Equatorial Current or along the boundary between this current and the intermittent Guinea Current. It may be of interest to point out that the highest sea-surface temperatures recorded by the Carnegie in the North Atlantic occurred in this region.

It may also be noteworthy that there is remarkable uniformity of temperature in the Caribbean Sea. The sea-surface temperature remained between 28° and 29° during all that part of the cruise from latitude 13° north, longitude 54° west, to Colon, a distance of approximately 1500 miles.

Sea-Surface Temperatures in the North Pacific Ocean

Sea-surface isotherms for the North Pacific Ocean have been plotted along the route followed by the Carnegie and the results are presented in figure 29 and 30. Only two zones of marked temperature variation appear to exist: one (I) off the coast of California in the latitude of San Francisco, where the Carnegie crossed the California Current, and the other (II) off the northwest coast of Japan, where the course of the Carnegie appears to have paralleled the boundary between the cold Oyashio Current and the warmer Kuroshio Current. During the period when the Carnegie remained in port at Yokohama (June 7 to 24, 1929), sea-surface temperatures, in general, appear to have increased about 6°, indicating a significant change in water mass in this area during the three-week period.

On June 30, 1929, in latitude 38° north, longitude 147° east, a sudden fall in temperature of 5°.8 occurred between 08h and 09h 30m, revealing a very sharp temperature discontinuity between the two currents at this point.

Sea-surface temperatures throughout the southwestern North Pacific were extremely uniform; the extreme temperature variation for that part of the cruise from the equator at longitude 172° west to Guam amounted to only 1°.

Sea-Surface Temperatures in the South Pacific Ocean

Sea-surface isotherms for the South Pacific Ocean, as determined from the Carnegie data, are shown in figure 29 and 30. Here, again, there appear to be only two Zones presenting marked temperature gradients. The first (I) occurs to the south of the Galápagos Islands within the comparatively cold waters of the Southern Equatorial Current, a region of marked divergence, and the other (II) occurs off the coast of Peru in the latitude of Callao, where the Carnegie crossed the cold Coastal Peru Current, which flows very close to the coast in this region. The temperature gradient across the Coastal Peru Current, was not as steep as has been indicated by previous investigations made during summer months in this region.

Sea-surface temperatures throughout most of the remainder of the cruise in the South Pacific were very uniform, although there appear to be slight concentrations of isotherms in the area around Easter Island and again in latitude 36° south, longitude 105° west. These latter Zones are too far north to be under the influence of the zone of subtropical convergence; thus these temperature irregularities must be due to some displacement of the usual South Pacific drift.

CONCLUSION

In concluding this section on sea-surface temperatures, it may again be emphasized that since differences between sea and air temperatures are usually less than 1°, for purposes of studying the effects of sea-surface temperature on the physical processes of the atmosphere it becomes necessary to obtain air temperatures accurate to the nearest 0°.1. For this purpose, methods must be devised for obtaining these continuous air temperatures free from the local effects of heating and cooling. It has been shown that it is possible to ascertain sea-surface temperatures with considerable accuracy.

The Carnegie data indicate that if air temperatures could be obtained a few meters above the sea surface, free from the effects of insolation, radiation, and artificial heating, it would be found that even the mean hourly air temperatures would seldom be above the mean hourly sea temperatures. Certainly the sea exerts a tremendous thermal influence on the atmosphere.

HUMIDITY

INSTRUMENTS AND METHODS

It is difficult to discuss separately the instruments used for obtaining air temperatures and humidities on the Carnegie in that each of the four sets of thermal instruments contained a wet- and a dry-bulb element. Therefore, since the mounting of the instruments has previously been discussed under the section on air temperature, only the wet-bulb equipment and methods will be elaborated on here.

Assmann Aspiration Psychrometer

Psychrometric observations were made daily at noon (GMT) with an Assmann psychrometer, and the wet-bulb readings were used for correcting the wet-bulb records of the recording psychrometers. The wet-bulb tube of this instrument (P.T.R. No. 2450-1928) was a standard thermometer, and needed no corrections throughout the range of temperature encountered on the cruise. The usual precautions in using this instrument were observed.

Negretti-Zambra Recording Psychrometer

The Negretti-Zambra capillary ventilating recording psychrometer was housed in the Stevenson screen on deck; the electric motor which operated the centrifugal ventilating fan was mounted outside the screen proper and communicated with the psychrometer through a coil-spring coupling. The wick was moistened from a shallow well immediately below the bulb, which was kept filled with distilled water from a reservoir connected to the well by a copper tube. The wicks were changed at frequent intervals.

The Negretti-Zambra apparatus, especially the ventilating mechanism, required constant repairs. As the equipment was mounted athwartships, the rolling of the vessel produced strains on the coupling of the electric motor, which resulted in frequent breakdowns. In addition, occasional failures of the electric current supplying power to the ventilating motor resulted in false readings. The observer was usually notified when this occurred, however, and appropriate notations and corrections were entered on the trace.

No accurate check of the rate of ventilation was kept, but it was always sufficient to insure adequate ventilation of the wet-bulb except in the instances outlined above.

It was frequently necessary to adjust the wet-bulb recording pen because of its tendency to fall slowly below the true values as determined by the Assmann psychrometer. Moreover, occasional spatial corrections were necessary owing to the fact that the psychrogram paper was noticeably affected by moisture and tended to buckle away from the drum during periods of rain or fog.

Hartmann and Braun Electrical-Resistance Psychrometers

Three pairs of Hartmann and Braun electrical-resistance recording psychrometers were mounted on the vessel at various heights above the deck (cf. fig. 2). The first was located in the Stevenson screen on deck (3.6 meters above sea level), the second was housed in a small naturally ventilated screen above the crosstrees on the mainmast (21.9 meters above sea level), and a third was mounted in a similar shelter near the main truck (34.6 meters above sea level).

These instruments were calibrated at frequent intervals against readings of the Assmann psychrometer; the one in the Stevenson screen was compared daily.

The value of the recorded wet-bulb temperatures depends on the efficiency of the screens to a much greater extent than is true in the case of dry-bulb readings. Obviously, the air movement through these naturally ventilated instrument shelters on the mast must frequently have been too slight to allow adequate ventilation of the wet-bulb. Therefore, it has not been possible to use the Hartmann and Braun traces to obtain continuous records of wet-bulb lapse rates.

Evaluation of Psychrograms

The corrections to the Negretti-Zambra and Hartmann and Braun psychrographs were found by means of the noon readings of the Assmann psychrometer. These corrections were entered directly on the psychrograms and used to construct a corrected curve for obtaining the hourly values of wet-bulb temperature. The differences between the hourly values of wet- and dry-bulb temperatures were later used for finding the vapor pressures and relative humidities according to the "Aspirations-Psychrometer Tafelen" [Prussian Met. Inst., 1930].

It is realized that the humidity observations are no more accurate than are the temperature readings themselves. It is believed, however, that the errors in the cases of both wet- and dry-bulb readings should tend to cancel one another; for example, both will be affected in the same manner by overheating of the thermometers, etc., and the differences between the wet- and dry-bulb readings, therefore, should remain more or less constant. Thus, although the actual humidity measurements may be in error, the relation between humidity and air temperature should not vary greatly as the result of such errors.

Wet-Bulb Lapse Rates Between Deck, Crosstrees, and Mainmast

As explained, it has been impossible to obtain continuous records of wet-bulb lapse rates between the Hartmann and Braun instruments at deck, crosstrees, and mainmast because of the possibility of errors in air-temperature measurement resulting from overheating and undercooling of the thermometers. Reliable observations are available in several cases, however, as a result of a calibration of the Hartmann and Braun instruments made with the Assmann psychrometer. The wet-bulb lapse rates recorded were usually normal, but three specific cases have been selected for discussion for the reason that they all were decidedly superadiabatic (see figure 15).

1. July 29, 1928, at 12h, off the coast of Iceland: The wet-bulb lapse rate was 1.°1 between deck and masthead or six times the saturated adiabatic rate. The weather was cloudy with a moderate northwest breeze. The sea was moderate with a surface temperature of 11.°6.

2. January 14, 1929, at 10h, entering the port of

Callao: The wet-bulb lapse rate was 1°0 between deck and crosstrees or nine times the saturated adiabatic rate. The wind was south-southeast, force 3, weather cloudy, sea temperature 18°8.

3. March 12, 1929, at 11h, approaching the island of Tahiti: The wet-bulb lapse rate was 1°1 in the 35 meters between deck and masthead, or six times the saturated adiabatic rate. The weather was squally with a gentle northwest breeze. The sea-surface temperature was 28°3.

As suggested by Miss Clarke [23, p. 185], in all probability these observed values were greatly influenced by radiation from deck, sails, and screen. No doubt the elements at the masthead were less affected than the other two elements -- a difference which tended to produce apparent superadiabatic rates.

Table 44. Mean hourly values of vapor pressure in millimeters for groups, Carnegie, 1928-29

(Corrected for noncyclic change)

Group	Dates	No. days	Mean		Local mean hours		
			Latitude	Longitude	0	1	2
	1928		°	°	mm	mm	mm
I	July 29-Aug. 6	9	56.3 N	40.7 W	7.84	7.88	7.77
II	Aug. 7-10	4	42.8 N	47.8 W	12.46	12.45	12.31
III	Aug. 11-23	13	29.0 N	42.0 W	20.70	20.58	20.48
IV	Aug. 24-Sep. 15 [a]	21	11.8 N	43.0 W	21.19	21.12	21.14
V	Oct. 2-10	9	13.8 N	71.0 W	22.52	22.49	22.65
VI	Oct. 26-Nov. 6	12	4.0 N	81.0 W	20.86	20.75	20.56
VII							
(a)	Nov. 7-Dec. 21 [b]	35	16.5 S	104.3 W	14.99	14.94	15.03
(b)	Feb. 22-28, 1929	7	13.1 S	119.4 W	18.63	18.51	18.53
VIII	Dec. 22-31 [c]	8	37.2 S	96.7 W	12.81	12.82	12.68
	1929						
IX	Jan. 1-14	14	24.7 S	83.3 W	13.25	13.09	12.89
X	Feb. 6-17	12	12.3 S	88.2 W	17.00	17.00	17.00
XI	Mar. 1-31 [d]	21	16.8 S	147.9 W	21.24	21.01	21.05
XII	Apr. 22-May 31 [e]	32	9.7 N	168.7 E	21.87	21.61	21.58
XIII							
(a)	June 1-30 [f]	13	34.3 N	143.1 E	16.22	16.14	15.91
(b)	July 1-3	3	39.6 N	149.4 E	10.81	10.69	10.58
XIV	July 4-21 [g]	19	47.7 N	179.5 W	8.78	8.79	8.78
XV	July 22-28	7	41.5 N	131.8 W	10.56	10.42	10.37
XVI	Sep. 4-8	5	34.1 N	126.3 W	12.46	12.30	12.11
XVII							
(a)	Sep. 9-16	8	27.8 N	136.6 W	14.66	14.52	14.57
(b)	Sep. 17-Oct. 7 [h]	8	27.0 N	155.1 W	17.50	17.70	17.53
(c)	Oct. 11-25 [i]	14	25.2 N	140.7 W	16.73	16.68	16.59
XVIII	Oct. 26-Nov. 14	20	0.1 S	150.5 W	20.97	20.95	20.98

Group	Local mean hours										
	3	4	5	6	7	8	9	10	11	12	13
	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
I	7.82	7.82	7.80	7.83	7.74	7.74	7.84	8.02	8.02	8.11	8.16
II	12.12	12.14	12.16	12.32	12.37	12.52	13.03	13.04	13.36	13.20	13.01
III	20.57	20.53	20.37	20.37	20.83	20.94	20.91	21.29	21.43	21.45	21.68
IV	21.09	21.20	21.10	21.29	21.24	21.38	21.56	22.02	21.98	22.09	22.10
V	22.47	22.62	22.42	22.99	23.00	22.99	23.03	23.00	22.79	22.96	23.29
VI	20.63	20.78	20.89	20.89	20.83	21.05	21.13	21.04	20.94	21.12	21.18
VII											
(a)	15.05	15.20	15.21	14.97	15.18	15.10	15.06	15.15	15.12	15.13	15.13
(b)	18.36	18.47	18.39	18.49	18.61	18.75	18.71	18.82	18.80	18.74	18.68
VIII	12.75	12.70	12.73	12.74	12.91	12.87	13.02	13.12	13.05	13.02	13.13
IX	12.99	12.97	12.96	13.17	13.24	13.42	13.34	13.47	13.47	13.79	13.86
X	16.91	17.03	16.89	17.09	17.21	17.42	17.40	17.47	17.54	17.57	17.54
XI	21.07	21.14	21.02	20.98	21.00	21.12	21.12	21.33	21.40	21.23	21.11
XII	21.47	21.54	21.28	21.38	21.43	21.54	21.56	21.72	21.72	21.70	21.81
XIII											
(a)	15.93	15.84	15.70	15.78	15.73	15.82	15.88	15.86	15.99	15.98	15.97
(b)	10.66	10.79	10.73	10.76	10.93	10.83	10.80	10.90	10.94	11.03	10.83
XIV	8.61	8.61	8.60	8.63	8.62	8.58	8.60	8.61	8.64	8.67	8.65
XV	10.43	10.38	10.50	10.32	10.24	10.34	10.30	10.44	10.58	10.47	10.44
XVI	11.99	12.33	12.22	12.24	12.38	12.12	12.01	11.83	11.79	12.02	12.03
XVII											
(a)	14.37	14.56	14.62	14.65	14.68	14.60	15.01	14.78	14.52	14.55	14.63
(b)	17.84	17.58	17.52	17.28	17.31	17.34	17.43	17.47	17.42	17.79	17.75
(c)	16.85	16.80	16.82	16.92	16.77	16.79	16.73	16.88	16.73	16.82	16.83
XVIII	20.73	20.79	20.76	20.67	20.73	21.04	21.03	21.05	20.88	20.90	20.92

Table 44. Mean hourly values of vapor pressure in millimeters for groups, Carnegie, 1928-29--Concluded

Group	Local mean hours										Mean
	14	15	16	17	18	19	20	21	22	23	
	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
I	8.26	8.16	8.30	8.21	8.16	8.08	8.06	8.06	8.01	8.06	7.98
II	12.93	12.85	12.71	12.80	12.78	12.67	12.41	14.42	12.59	12.55	12.63
III	21.34	21.59	21.50	21.64	21.42	21.04	21.04	20.96	20.84	20.90	21.00
IV	21.99	21.85	21.75	21.46	21.30	21.16	21.11	21.11	21.13	21.28	21.43
V	23.05	22.99	22.85	22.66	22.74	22.47	22.23	22.35	22.35	22.49	22.72
VI	21.13	21.01	21.07	21.02	20.92	20.91	20.89	20.89	20.86	20.89	20.92
VII											
(a)	15.23	15.23	15.10	15.11	15.09	15.05	14.91	15.00	15.05	14.94	15.08
(b)	18.81	18.72	18.65	18.59	18.53	18.48	18.49	18.59	18.43	18.41	18.59
VIII	12.93	12.91	12.88	12.76	12.83	12.72	12.68	12.71	12.66	12.69	12.84
IX	13.93	14.00	13.93	13.85	13.64	13.51	13.52	13.48	13.31	13.31	13.43
X	17.40	17.28	17.28	17.38	17.12	17.10	17.17	17.10	17.08	17.10	17.20
XI	21.39	21.30	20.86	20.94	20.96	20.84	20.96	20.98	21.07	21.01	21.09
XII	21.83	21.65	21.70	21.84	21.66	21.71	21.88	21.88	21.77	21.95	21.68
XIII											
(a)	15.88	15.95	15.99	15.93	15.84	15.75	15.74	15.71	15.82	15.92	15.90
(b)	10.80	10.83	10.77	10.87	10.71	10.61	10.71	10.81	10.75	10.81	10.79
XIV	8.70	8.57	8.60	8.57	8.56	8.58	8.64	8.67	8.68	8.73	8.65
XV	10.70	10.70	10.88	10.76	10.64	10.79	10.64	10.75	10.72	10.66	10.54
XVI	12.17	11.99	12.34	12.30	12.44	12.24	12.19	12.21	12.19	12.10	12.18
XVII											
(a)	14.76	14.69	14.68	14.45	14.30	14.43	14.51	14.53	14.64	14.49	14.59
(b)	17.66	17.65	17.71	17.65	17.40	17.48	17.31	17.33	17.36	17.36	17.52
(c)	16.75	16.79	16.78	16.68	16.43	16.43	16.62	16.63	16.66	16.70	16.73
XVIII	20.77	20.63	20.61	20.65	20.65	20.62	20.67	20.69	20.92	20.87	20.82

Days omitted as follows: (a) Aug. 25, 26; (b) Dec. 3-12; (c) Dec. 25, 26; (d) Mar. 4, 13-20, 26; (e) May 6, 11, 20-25; (f) June 8-24; (g) Two dates July 14 on crossing 180° meridian; (h) Sep. 20-Oct. 2 (i) Oct. 18.

DISCUSSION OF VAPOR PRESSURE

Mean Vapor Pressures for Groups

The mean hourly values of vapor pressure for the various Groups are presented in table 44. It may be observed that the variation from group to group of the mean hourly vapor pressures is very similar to the corresponding variation of the mean hourly sea and air temperatures. Obviously, vapor pressure is largely a function of air and sea temperature.

Maxima and Minima of Vapor Pressure

The absolute maximum and minimum vapor pressures for the various groups are presented in table 45. As would be expected, the higher vapor pressures were recorded in the tropics. The absolute maximum vapor pressure (25.5 mm) was recorded at 06h, October 10, 1928, in latitude 10°.3 north, longitude 79°.3 west. The air temperature at this time was 27°.4, the sea-surface temperature 28°.5. The absolute minimum vapor pressure (6.8 mm) was observed at 18h, July 8, 1929, in latitude 46°.9 north, longitude 163° west. The air temperature on this occasion was 6°.8, the sea-surface temperature 6°.9. It may be remarked that the minimum sea-surface (6°.4) and the minimum air (6°.3) temperatures were also registered on this date, the former at noon and the latter between 19h and 20h.

The greatest daily range in vapor pressure (5.2 mm) occurred on November 2, 1928, between the Gulf of Panama and the Galápagos Islands. The sky was overcast during this period, with frequent rain squalls. The least

Table 45. Absolute maximum and minimum vapor pressures for groups, Carnegie, 1928-29

Group	Maximum	Minimum	Daily range	
			Maximum	Minimum
	mm	mm	mm	mm
I	9.2[a]	6.9	2.0	0.4
II	20.2	8.9	6.2	1.3
III	24.2	17.3	3.9	1.1
IV	24.9	18.7	4.0	1.5
V	25.5[b]	19.7[b]	4.2	1.0
VI	24.9	16.3	5.2[b]	0.9
VII				
(a)	20.1	11.4	5.0	0.5
(b)	19.7	16.9	1.5	0.8
VIII	15.0	10.5	3.2	0.9
IX	16.7	10.1	3.3	1.1
X	19.6	14.7	3.0	1.2
XI	24.3	18.0	3.7	0.9
XII	24.2	18.0	3.4	0.6
XIII				
(a)	21.5	10.9	4.7	1.8[b]
(b)	12.6	9.3	2.1	1.0
XIV	10.1	6.8[a]	1.3[a]	0.3[a]
XV	13.2	8.4	2.8	0.6
XVI	13.8	10.4	2.3	0.8
XVII				
(a)	17.3	12.1	2.9	0.9
(b)	21.7	15.4	4.1	1.0
(c)	22.0	11.8	3.9	0.9
XVIII	23.1	17.6	3.6	0.7

[a] Absolute minimum values for cruise.
[b] Absolute maximum values for cruise.

Table 46. Mean maximum and minimum vapor pressures for groups, Carnegie, 1928-29

Group	Maximum [c]	Minimum [c]	Daily range [c]
	mm	mm	mm
I	8.48 [a]	7.48 [a]	1.00
II	14.18	10.90	3.28 [b]
III	20.34	17.70	2.64
IV	22.61	20.43 [b]	2.18
V	23.82 [b]	21.36 [b]	2.46
VI	22.02	19.71	2.31
VII			
(a)	15.47	14.15	1.32
(b)	19.11	17.91	1.20
VIII	14.93	13.31	1.62
IX	14.39	12.36	2.03
X	18.03	16.21	1.82
XI	21.98	20.08	1.90
XII	22.58	20.73	1.85
XIII			
(a)	17.32	14.67	2.65
(b)	11.57	10.00	1.57
XIV	9.07	8.33	0.74 [a]
XV	11.49	9.66	1.83
XVI	12.90	11.42	1.48
XVII			
(a)	15.29	13.61	1.68
(b)	19.17	16.97	2.20
(c)	17.84	15.25	2.59
XVIII	21.69	19.88	1.81
Weighted mean	17.972	16.115	1.857

[a] Minimum values for all groups. [b] Maximum values for all groups. [c] Unperiodic.

Table 47. Hour of mean maximum and minimum vapor pressure by groups, Carnegie, 1928-29

Group	LMT	Mean Maximum [a]	LMT	Mean Minimum [a]
	h	mm	h	mm
I	16	8.30	7, 8	7.74
II	12	13.20	3	12.12
III	13	21.68	2	20.48
IV	13	22.10	3	21.09
V	13	23.29	20	22.23
VI	13	21.18	2	20.56
VII				
(a)	14, 15	15.23	20	14.91
(b)	10	18.82	3	18.36
VIII	13	13.13	22	12.66
IX	15	14.00	2	12.89
X	12	17.57	5	16.89
XI	11	21.40	19	20.84
XII	23	21.95	5	21.28
XIII				
(a)	0	16.22	5	15.70
(b)	12	11.03	2	10.58
XIV	1	8.79	18	8.56
XV	16	10.88	7	10.24
XVI	0	12.46	11	11.79
XVII				
(a)	9	15.01	18	14.30
(b)	3	17.84	6	17.28
(c)	6	16.92	2	16.59
XVIII	2	20.98	16	20.61

[a] Periodic

daily range (0.3 mm) occurred on July 19, 1929, in the Gulf of Alaska. It is significant that this period was also overcast but with light drizzling rain instead of showers as in the previous case.

The mean values and times of daily maximum and minimum vapor pressures for the various Groups are given in tables 46 and 47, which indicates that vapor pressures were highest in the Caribbean Group and low-

Table 48. Frequencies of hours of occurrence of maximum vapor pressure, Carnegie, 1928-29

Group	Local mean hours																	
	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
I	1	1	1	...	...	...	...	1	...	...	...	4	2	4	1	...	...	...
II	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	2	...
III	...	...	...	...	...	...	...	2	2	...	...	...	2	2	5	1	1	...
IV	...	...	...	...	...	1	...	1	5	6	6	4	3	...	1	...	...	...
V	...	...	...	1	1	...	...	...	1	...	2	1	1	...	1	2	1	...
VI	...	...	1	2	1	1	3	1	1	2	1	1	...	1	...	...	...	...
VII																		
(a)	2	1	3	5	1	2	4	...	...	...	2	4	4	4	1	...	2	1
(b)	...	1	...	...	...	1	...	1	1	1	1	4	1	1	...	...	...	...
VIII	...	...	...	...	...	1	1	2	2	1	1	1	2	...	...	...	1	1
IX	...	...	...	...	1	1	...	1	...	1	1	4	3	2	...	2	...	...
X	...	...	...	...	1	...	...	1	1	1	2	2	1	1	2	...	1	...
XI	...	2	1	...	...	...	...	4	1	...	2	3	...	1	1	...	1	1
XII	1	2	...	2	...	...	...	2	2	1	2	...	...	...	2	2	2	1
XIII																		
(a)	...	...	...	1	...	...	...	...	...	...	...	1	...	1	1	1	...	...
(b)	...	...	...	1	...	...	...	...	...	...	...	...	...	1	...	...	...	...
XIV	2	1	1	1	2	1	1	1	1	1	3	4	...	...	...	1	1	2
XV	...	...	...	...	...	...	2	...	1	...	...	...	...	1	...	...	1	1
XVI	...	1	...	...	...	...	...	...	...	...	...	...	...	....	1	2	...	...
XVII																		
(a)	1	1	1	1	...	...	...	1	...	...	1	1	1	1	1	1	...	...
(b)	1	...	...	...	...	...	...	1	2	1	1	1	3	...	1	...	...	...
(c)	...	1	...	1	...	...	1	2	...	...	2	1	...	...	2	...	...	1
XVIII	...	...	...	2	...	1	1	1	2	2	2	...	...	...	2	...	...	...
Total	8	11	8	17	7	9	13	22	23	17	29	36	24	20	22	12	13	8

Table 49. Frequencies of hours of occurrence of minimum vapor pressure, Carnegie, 1928-29

Group	Local mean hours															
	17	18	19	20	21	22	23	0	1	2	3	4	5	6	7	8
I	...	...	1	1	2	1	1	1	...	1	2	1	2	...	2	3
II	...	...	...	...	...	...	...	1	...	...	1	1	1	2	...	...
III	...	1	...	...	2	2	...	1	1	2	2	2	4	2	...	...
IV	...	3	2	1	1	1	1	3	4	4	1	...	2	...	1	...
V	...	...	...	1	...	2	...	...	1	1	...	...	1	...	1	...
VI	1	...	1	...	...	2	...	1	1	1	2	...	1	1	...	...
VII																
(a)	1	...	1	3	2	1	1	...	3	1	4	1	6	1	4	3
(b)	1	...	1	1	1	...	...	...	2	1	1	...	1	2	1	...
VIII	...	...	1	2	...	1	2	1	...	1	...	1	1	1	...	1
IX	...	...	...	...	1	2	1	2	2	3	1	1	1	1	...	...
X	...	...	1	1	1	1	1	2	2	2	1	...	2	...	...	...
XI	1	2	3	2	1	1	2	1	2	2	2	1	1	1	1	1
XII	2	3	2	1	3	3	1	1	1	...	3	1	3	5	3	1
XIII																
(a)	...	1	2	3	2	3	...	1	...	1	1	...	1	...	1	...
(b)	...	...	1	...	...	...	1	1	1	1	...	...	...	...	...	...
XIV	...	2	...	2	2	1	2	1	3	1	1	3	1	...	1	2
XV	...	1	...	1	...	1	1	...	1	...	...	2	...	...	...	...
XVI	...	...	...	...	1	...	...	...	...	...	2	...	...	...	...	...
XVII																
(a)	...	1	...	...	...	...	1	1	1	1	1	1	1	...	...	...
(b)	...	...	...	1	...	...	2	2	1	...	2	2	1	...	1	...
(c)	1	3	1	...	1	1	1	3	...	...	1	2	...	...	2	...
XVIII	3	1	...	...	2	...	3	...	...	...	1	3	1	4	2	...
Total	10	18	17	20	22	23	21	23	26	23	29	22	31	20	20	11

Table 50. Frequency distribution of the unperiodic diurnal amplitude of vapor pressure, Carnegie, 1928-29

Range (mm)	No. days	Percentage of total	Cumulative percentage	
< 1.0	32	10.4	10.4	100.0
1-2	144	47.1	57.5	89.6
2-3	92	30.1	87.6	42.5
> 3.0	38	12.4	100.0	12.4
Total	306	100.0	.....	.....

Table 51. Mean unperiodic diurnal amplitude of vapor pressure for ranges in latitude, Carnegie, 1928-29

Range in latitude	Amplitude	No. days	Range in latitude	Amplitude	No. days
° °	mm		° °	mm	
> 45 N	0.8	27	5 N- 5 S	1.8	34
45 N-35 N	2.2	26	5 S-15 S	1.8	37
35 N-25 N	2.3	40	15 S-25 S	2.0	31
25 N-15 N	1.9	32	25 S-35 S	2.1	24
15 N- 5 N	2.2	46	35 S-45 S	1.4	9
	Mean and total		.....	1.8	306

est in the South Greenland Group. It might be mentioned that the prevailing winds during most of the period that the Carnegie spent in the South Greenland Group were from some northerly direction, and thus it may be assumed that much of the air imported to this region during the period was Polar Continental.

The frequencies of hours of occurrence of maximum and minimum vapor pressure are illustrated in tables 48 and 49. It can be seen that the data are quite scattered, although there is positive indication that the maximum vapor pressure tends to occur around 14h with the greatest frequency. This result appears reasonable in that the period falls between the most frequent hours for maximum sea-surface- and air-temperature occurrence (15h and 13h respectively). There is also a slight indication of a tendency toward a secondary maximum frequency at 06h. We should expect this hour also to present the maximum stability in the air immediately above the sea surface. Under such conditions it is conceivable that this hour might frequently be one of maximum vapor pressure in that convection would not be mixing the moist surface layers of air with drier air aloft.[a] We should expect this effect to be most pronounced during clear, calm weather and especially when the sea-surface temperature is very near the surface air temperature.

The minimum vapor pressure seems to occur around 05h with the greatest frequency, simultaneously with the most frequent hour for minimum air-temperature occurrence. This is exactly the result which would be expected under average conditions.

Diurnal Variation of Vapor Pressure

General Remarks

Table 44 contains the mean hourly values of vapor pressure for the various Groups of Carnegie data. It will be noted that there is considerable variation in the

[a] There is also a strong possibility that a tendency to wash-down the decks of the Carnegie at about this hour would frequently account for such maxima.

Table 52. Results of Fourier analyses of diurnal variation of vapor pressure for groups, Carnegie, 1928-29

Group	Coefficients					
	a_1	a_2	a_3	b_1	b_2	b_3
	mm	mm	mm	mm	mm	mm
I	-0.098	+0.026	-0.009	-0.193	+0.039	-0.015
II	-0.354	+0.189	+0.018	-0.151	-0.100	-0.095
III	-0.392	+0.095	+0.028	-0.374	+0.014	+0.057
IV	-0.341	+0.098	-0.011	-0.064	+0.062	-0.013
V	-0.317	+0.037	+0.095	+0.092	+0.055	-0.035
VI	-0.165	+0.015	+0.024	-0.058	-0.039	-0.046
VII						
(a)	-0.081	-0.019	-0.009	+0.021	+0.050	-0.017
(b)	-0.102	+0.127	-0.009	+0.047	+0.010	-0.012
VIII	-0.179	+0.075	+0.015	+0.025	-0.013	+0.031
IX	-0.305	+0.036	+0.058	-0.313	+0.028	-0.067
X	-0.253	+0.071	+0.013	-0.032	-0.064	+0.016
XI	-0.102	+0.066	+0.044	-0.004	-0.024	+0.017
XII	+0.008	+0.111	+0.012	-0.177	-0.053	-0.005
XIII						
(a)	+0.004	+0.118	+0.073	-0.010	+0.061	+0.047
(b)	-0.085	+0.038	+0.014	+0.017	-0.032	-0.029
XIV	+0.048	+0.068	+0.013	+0.008	+0.006	-0.006
XV	+0.013	-0.007	-0.001	-0.211	+0.014	-0.023
XVI	+0.114	-0.104	+0.071	-0.051	+0.045	-0.034
XVII						
(a)	-0.079	+0.037	+0.068	+0.062	-0.031	-0.053
(b)	-0.053	+0.089	-0.029	-0.020	+0.169	+0.048
(c)	-0.058	+0.029	+0.005	+0.101	+0.034	-0.064
XVIII	-0.006	+0.130	+0.036	+0.101	-0.064	+0.040

Group	Amplitudes			Phase angles		
	c_1	c_2	c_3	ϕ_1	ϕ_2	ϕ_3
	mm	mm	mm	°	°	°
I	0.216	0.047	0.017	206.9	33.7	211.0
II	0.385	0.214	0.097	246.9	117.9	169.3
III	0.542	0.096	0.063	226.3	81.6	26.2
IV	0.347	0.116	0.017	280.6	57.7	220.2
V	0.330	0.066	0.101	286.2	33.9	110.2
VI	0.175	0.042	0.052	250.6	159.0	152.4
VII						
(a)	0.084	0.054	0.019	284.6	339.2	207.9
(b)	0.112	0.127	0.015	277.9	99.8	25.8
VIII	0.181	0.076	0.034	224.3	52.1	139.1
IX	0.437	0.046	0.089	262.8	132.0	39.1
X	0.255	0.090	0.021	272.2	110.0	68.9
XI	0.102	0.070	0.047	294.7	85.5	216.9
XII	0.177	0.123	0.013	177.4	115.5	112.6
XIII						
(a)	0.011	0.133	0.087	158.2	62.7	57.2
(b)	0.087	0.050	0.032	281.3	130.1	154.2
XIV	0.049	0.068	0.014	80.5	85.0	114.8
XV	0.211	0.016	0.023	176.5	333.4	182.5
XVI	0.125	0.113	0.079	114.1	293.4	115.6
XVII						
(a)	0.100	0.048	0.086	308.1	130.0	127.9
(b)	0.057	0.191	0.056	249.3	27.8	328.9
(c)	0.122	0.045	0.064	320.1	40.5	175.5
XVIII	0.101	0.145	0.054	356.6	116.2	42.0

curves of mean hourly vapor pressure between the Groups even when corrected for noncyclic changes, which would indicate that the diurnal variation of this element is so small that it is usually masked by chance variations. Only in those groups which contain a large number of days of observations do the diurnal curves of vapor pressure appear to be consistent.

Diurnal Variation of Vapor Pressure for all Days

Only by using the observations of a large number of days can a true picture of the diurnal variation of vapor pressure over ocean surfaces be formed. For this reason, the mean hourly values of vapor pressure for all days of the cruise have been computed and the results presented in figure 31. It would be expected that the di-

urnal curve of vapor pressure would follow the curve of mean hourly air temperature very closely. The Carnegie data appear to bear out this conclusion (compare fig. 31 with fig. 16). Although the curve of mean hourly vapor pressure is somewhat irregular, there definitely appears to be a well-defined maximum at 13h, as was the case with air temperature, and a less well-defined minimum at 05h.

Variation of the Diurnal Amplitude of Vapor Pressure with Latitude

As shown in table 51, the diurnal amplitude of vapor pressure appears to vary with latitude in much the same manner as the diurnal amplitude of air temperature for the ranges of latitude north of the equator, with maxima at mean latitudes ±10° and ±30°, and with minima at mean latitudes ±20° and at the equator. It may also be observed that the amplitude at 10° mean south latitude is less than at mean latitude 10° north in both cases, signifying that identical conditions tend to produce maxima and minima in the diurnal amplitudes of both air temperature and vapor pressure.

Effect of Wind on the Diurnal Amplitude of Vapor Pressure

The mean unperiodic amplitude of vapor pressure has been computed for fifty-two days in tropical regions between latitudes ±20° with a wind force equal to or greater than 4, Beaufort scale, and for fifty-three days within the same latitude range with wind force less than 4. The results give an amplitude of 1.69 mm for days with wind force equal to or greater than 4, and one of 2.02 mm for days with wind force less than 4. Obviously the wind tends to reduce the daily range of vapor pressure, presumably because of the more thorough mixing of the surface layers of air.

Harmonic Analysis of Vapor-Pressure Data

As shown in table 52, the amplitudes and phase angles for the 24-hour, 12-hour, and 8-hour terms are extremely variable between the various Groups. There appears to be some regularity, however, in the time of occurrence of the maximum, which generally appears about 13h. The average periodic amplitude of vapor pressure for all Groups is 0.2 mm.

Table 53. Variation of vapor pressure with differences between sea and air temperature, Carnegie, 1928-29

Δt Temperature	Vapor pressure	No. days
°C	mm	
> +1.0	17.73	16
+0.6 to +1.0	16.22	31
< +0.6	17.44	41
< -0.6	16.45	54
-0.6 to -1.0	13.63	18
> -1.0	12.69	14
Mean and total	15.69	174
Weighted mean	16.17	....

Variation of Vapor Pressure with Sea- and Air-Temperature Differences

In order to determine the effect of differences of sea and air temperatures (sea minus air) on vapor pressure, a sampling of the data has been made and the distribution of vapor pressures for various ranges of sea- and air-temperature differences has been determined for 174 days of observations. An attempt was made to obtain a true sampling, care being exercised to secure equal numbers of days with given representative temperatures and vapor pressures. It is realized that such a method is faulty and might lead to erroneous interpretations. Two separate sets of data were first analyzed, however, (82 and 92 days respectively), and both sets of data, separately, produced essentially the same results, although in one case the difference between the mean values at ranges +0.6 to +1.0 °C and less than +0.6 °C was small, the two values being almost equal.

It is obvious from figure 33 that vapor pressure increases as the sea temperature becomes higher than air temperature, and lower as the air temperature becomes successively higher than sea temperature. Helland-Hansen [32, p. 12], from observations on the Michael Sars, has reached the same conclusions.

A plateau in the curve (fig. 33) might well be expected between the ranges +0.6 to +1.0 °C and less than +0.6 °C, as here the differences would be slight and affected by chance variations. The authors, however, hesitate to present further interpretations of this curve in view of the possibilities of inaccuracy due to faulty sampling.

Variation of Vapor Pressure with Latitude

Data concerning the mean vapor pressures for the various ranges of latitude are presented in figure 32. Comparing the curve in figure 32 with the curves for mean sea and air temperatures (fig. 14), it may be noted that the profiles are identical except between mean latitudes 30° and 40° south. Evidently, either the mean vapor pressure within the range of latitude 25° to 35° south is too low, or the value for the range 35° to 45° south is too high. It may be remarked that there were only nine days of observations within the range 35° to 45° south, and thus it is quite possible that the values for this range are too high. An examination of the log abstract was made in order to determine the type of weather which prevailed during the period that the Carnegie spent in these latitudes (December 21 to 29, 1928). It was found that the entire period was cloudy or foggy, winds prevailed from a northerly direction, and there were frequent intermittent rains. No doubt a longer series of observations within this range of latitude made under less persistent meterological conditions would give a lower mean value for vapor pressure.

A Comparison of Mean Vapor Pressure for Rain Days and Rainless Days

Owing to the loss of the Carnegie precipitation data when the vessel was destroyed, it is impossible to correlate changes in vapor pressure with amounts of precipitation. Data have been compared, however, for periods of thirty-one rain days and thirty-one fair days, all within the tropics between latitudes 20° north and 20° south. An attempt was made to secure a true sampling

of the data; for each rain day selected there has been chosen a fair day within the same region and with similar air temperature.

The results give a mean value of 21.20 mm for rain days, and one of 19.19 mm for fair days, showing that precipitation has a significant effect on vapor pressure.

Variation of Vapor Pressure with Air Temperature

It has been shown that the quantity of water vapor on rain days depends to a considerable extent on precipitation; on rainless days it must depend largely on air temperature. The curve shown in figure 34 was constructed using vapor-pressure and air-temperature data for approximately half the days of the cruise (150 days), and represents vapor pressure plotted as a function of air temperature. As we should expect, the profile of the curve is similar to that of the saturation curve of vapor pressure. It appears to depart more widely from the saturation curve at the intermediate temperatures (15° to 25°). This is not surprising when it is considered that these temperatures were obtained largely within the subtropical belts, where humidities are low with respect to air temperatures.

The curve in figure 34 may be quite closely represented by the empirical equation:

$$e = 0.03t^2 - 0.27t + 7.6$$

where e is vapor pressure expressed in millimeters of mercury, and t is air temperature (3.6 meters above the sea surface) expressed in degrees centigrade.

Vapor pressure was not plotted against sea-surface temperature since it seems obvious that a similar curve would be represented.

DISCUSSION OF RELATIVE HUMIDITY

Mean Relative Humidities for Groups

The mean hourly values of relative humidity for the various Groups are presented in table 54. It appears that the values are highest in the Groups in equatorial regions and in higher latitudes, and lowest in the Groups in the subtropical belts. This result is what would be expected when it is considered that relative humidity is a function of both vapor pressure (specific humidity) and air temperature. Thus, whereas vapor pressure depends to a great extent on air temperature, relative humidity is a function of the differences between these two elements. These differences appear to be greatest within the subtropical or trade-wind belts, where air moving toward the equator is being rapidly heated but is increasing its moisture content very slowly.

Maxima and Minima of Relative Humidity

The absolute maximum and minimum relative humidities for the various Groups are presented in table 55. As has just been indicated, the extreme maximum values are found in the higher latitudes and in equatorial regions. Relative humidities of 100 per cent were recorded on four days during the cruise for a total of six hours. These all occurred during July 1929, in the Alaskan Peninsula Group.

The absolute minimum relative humidity (53 per cent) was recorded at 16h, November 14, 1929, in lati-

Table 54. Mean hourly values of relative humidity in per cent for groups, Carnegie, 1928-29

(Corrected for noncyclic change)

Group	Dates	No. days	Mean		Local mean hours		
			Latitude	Longitude	0	1	2
	1928		°	°			
I	July 29-Aug. 6	9	56.3 N	40.7 W	86.8	87.4	86.2
II	Aug. 7-10	4	42.8 N	47.8 W	80.1	80.6	80.1
III	Aug. 11-23	13	29.0 N	42.0 W	82.4	82.2	81.9
IV	Aug. 24-Sep. 15 [a]	21	11.8 N	43.0 W	81.2	81.3	81.6
V	Oct. 2-10	9	13.8 N	71.0 W	80.0	79.8	80.6
VI	Oct. 26-Nov. 6	12	4.0 N	81.0 W	86.5	86.8	86.7
VII							
(a)	Nov. 7-Dec. 21 [b]	35	16.5 S	104.3 W	81.4	81.6	82.0
(b)	Feb. 22-28, 1929	7	13.1 S	119.4 W	74.7	74.5	74.9
VIII	Dec. 22-31 [c]	8	37.2 S	96.7 W	87.9	88.6	88.1
	1929						
IX	Jan 1-14	14	24.7 S	83.3 W	77.4	77.0	75.6
X	Feb. 6-17	12	12.3 S	88.2 W	78.4	79.1	78.9
XI	Mar. 1-31 [d]	21	16.8 S	147.9 W	76.8	77.4	77.3
XII	Apr. 22-May 31 [e]	32	9.7 N	168.7 E	81.0	80.4	80.1
XIII							
(a)	June 1-30 [f]	13	34.3 N	143.1 E	88.0	88.7	88.2
(b)	July 1-3	3	39.6 N	149.4 E	81.5	81.2	80.6
XIV	July 4-21 [g]	19	47.7 N	179.5 W	95.3	95.5	96.1
XV	July 22-28	7	41.5 N	131.8 W	86.0	84.9	85.3
XVI	Sep. 4-8	5	34.1 N	126.3 W	81.2	80.8	78.7
XVII							
(a)	Sep. 9-16	8	27.8 N	136.6 W	71.1	70.6	71.0
(b)	Sep. 17-Oct. 7 [h]	8	27.0 N	155.1 W	76.0	76.5	75.0
(c)	Oct. 11-25 [i]	14	25.2 N	140.7 W	80.4	80.8	81.1
XVIII	Oct. 26-Nov. 14	20	0.1 S	150.5 W	79.3	79.3	79.4

Table 54. Mean hourly values of relative humidity in per cent for groups Carnegie, 1928-29--Concluded

Group	Local mean hours										
	3	4	5	6	7	8	9	10	11	12	13
I	87.0	86.9	87.1	88.0	86.6	85.8	85.6	84.4	84.0	83.9	84.3
II	78.9	79.3	79.3	82.1	82.0	82.5	83.8	82.0	82.8	80.0	79.8
III	82.4	82.1	81.6	81.9	83.7	82.8	82.1	81.3	80.5	79.3	79.4
IV	81.4	81.8	81.2	81.3	80.1	78.6	77.1	76.2	74.9	75.8	75.8
V	80.7	81.0	80.5	81.1	80.0	78.5	78.2	78.8	77.7	77.1	77.9
VI	86.2	86.9	87.4	88.5	87.1	87.2	87.3	86.2	86.0	85.1	84.8
VII											
(a)	82.1	83.3	83.1	80.4	80.4	78.9	77.3	76.7	76.3	75.8	75.7
(b)	74.3	74.6	74.3	74.8	74.7	73.6	72.4	72.6	71.8	71.1	69.7
VIII	88.4	88.1	87.7	87.0	87.7	85.5	85.5	86.3	84.5	84.0	84.0
IX	76.2	76.3	76.3	75.9	74.9	74.6	73.3	72.2	71.1	72.5	72.2
X	78.3	78.8	78.4	78.5	77.8	77.5	76.4	75.7	75.2	74.2	74.3
XI	77.0	77.4	77.2	77.2	75.5	74.1	72.7	72.5	72.3	71.2	70.7
XII	80.1	80.6	79.9	80.2	79.4	78.7	77.7	77.4	76.4	76.2	76.4
XIII											
(a)	89.2	89.5	89.2	88.6	88.0	87.6	86.5	86.1	84.3	84.0	84.4
(b)	82.6	84.0	83.4	83.1	82.8	81.5	78.2	77.6	78.3	80.7	79.0
XIV	95.3	95.3	95.3	95.7	96.3	96.4	95.9	95.5	94.3	93.8	92.9
XV	85.2	85.5	87.2	84.8	83.9	83.9	84.2	83.5	84.0	81.7	80.3
XVI	77.0	79.2	78.6	78.5	79.8	78.6	78.2	76.1	73.0	75.4	75,2
XVII											
(a)	17.3	71.5	71.7	71.9	71.2	70.1	71.2	69.5	67.4	67.1	66.9
(b)	76.6	75.5	75.3	74.5	73.2	71.1	70.3	69.3	69.1	69.6	69.8
(c)	82.1	81.4	81.4	81.7	80.6	79.8	79.2	79.1	78.6	79.1	80.1
XVIII	78.5	78.8	79.1	78.7	78.3	77.0	75.4	74.6	73.6	73.0	73.9

Group	Local mean hours										Mean
	14	15	16	17	18	19	20	21	22	23	
I	85.1	84.4	85.8	86.0	85.3	86.1	87.1	87.8	87.6	89.0	86.20
II	79.5	78.2	77.2	78.2	77.4	79.1	78.7	79.7	79.9	79.9	80.05
III	78.2	79.4	79.2	81.0	81.6	82.2	82.9	82.9	82.3	83.0	81.55
IV	76.3	76.0	77.7	78.1	78.9	78.9	79.5	79.8	80.0	81.3	79.04
V	76.5	77.7	78.1	80.1	80.6	80.3	79.7	80.3	80.2	79.9	79.41
VI	84.7	84.4	84.4	85.6	86.2	87.2	87.0	86.8	86.7	86.5	86.35
VII											
(a)	76.5	77.6	77.8	78.8	79.6	80.1	79.7	80.7	80.9	81.1	79.57
(b)	70.0	70.6	71.7	71.8	72.3	73.0	73.3	74.4	73.7	73.5	73.08
VIII	84.2	84.8	84.4	84.5	85.8	85.9	86.4	86.3	86.8	87.4	86.31
IX	71.3	72.7	74.1	75.1	75.2	76.2	77.7	77.7	77.3	77.5	75.11
X	73.6	74.2	75.5	76.4	76.4	77.6	78.0	77.8	78.4	78.7	77.06
XI	73.0	73.9	73.3	73.8	74.4	75.2	75.8	75.7	76.8	76.5	74.98
XII	76.9	77.9	78.5	79.1	79.1	80.1	80.8	81.1	80.7	81.2	79.24
XIII											
(a)	83.7	84.3	85.3	85.4	86.3	87.2	87.5	87.8	87.8	87.8	86.94
(b)	79.1	79.8	79.5	80.9	79.2	79.6	80.6	82.4	81.7	81.2	80.80
XIV	93.2	92.4	93.3	93.7	94.2	94.9	95.4	95.4	95.5	95.6	94.90
XV	81.6	80.9	82.8	82.1	81.3	83.4	83.8	86.1	86.4	86.1	84.04
XVI	74.1	72.4	75.2	75.2	77.7	77.0	77.4	77.6	77.9	78.2	77.37
XVII											
(a)	66.6	66.4	66.5	66.5	67.7	69.4	70.3	70.1	70.4	70.0	69.50
(b)	70.0	71.4	74.1	73.8	74.2	75.2	74.1	74.1	74.4	74.8	73.36
(c)	79.5	79.4	79.6	79.6	79.7	79.2	80.1	80.4	80.5	79.8	80.14
XVIII	73.4	73.0	73.6	75.2	76.4	76.5	77.1	77.3	78.3	78.5	76.70

Days omitted as follows: (a) Aug. 25, 26; (b) Dec. 3-12; (c) Dec. 25, 26; (d) Mar. 4, 13-20, 26; (e) May 6, 11, 20-25; (f) June 8-24; (g) Two dates July 14 on crossing 180° meridian; (h) Sep. 20-Oct. 2; (i) Oct. 18.

tude 11.°6 south, longitude 163.°4 west, the same day on which the maximum sea-surface and air temperatures were recorded.

As shown in table 56, the Alaskan Peninsula Group presents the highest mean maximum relative humidity (98.4 per cent), whereas the lowest mean maximum (73.6 per cent) is recorded during the Carnegie's first stay in the Hawaiian Group (Group XVIIa). These two Groups also present the highest and lowest mean minimum relative humidities (91.0 per cent and 64.2 per cent respectively).

As indicated in table 54, the relative humidity in all Groups is high when compared with similar values for continental areas. The mean relative humidity for all days is 80.17 per cent, and the mean daily range is only 11.59 per cent.

Table 55. Absolute maximum and minimum relative humidity for groups, Carnegie, 1928-29

Group	Absolute		Daily range	
	Maximum	Minimum	Maximum	Minimum
	o/o	o/o	o/o	o/o
I	98	77	14	6
II	96	69	21	10
III	90	65	19	5
IV	92	61	19	5
V	90	65	14	4
VI	97	74	18	6
VII				
(a)	99	64	31[b]	7
(b)	78	65	13	5
VIII	99	68	22	5
IX	93	58	17	8
X	90	57	20	4
XI	92	65	20	6
XII	93	66	20	6
XIII				
(a)	99	76	17	5
(b)	91	74	15	8
XIV	100[b]	81	17	3[a]
XV	97	73	22	11
XVI	87	63	21	11
XVII				
(a)	82	57	14	6
(b)	88	58	20	5
(c)	92	63	23	9
XVIII	92	53[a]	21	5

[a] Absolute minimum value.
[b] Absolute maximum value.

Table 56. Mean maximum and minimum relative humidity for groups, Carnegie, 1928-29

Group	Mean		
	Maximum[c]	Minimum[c]	Daily range[c]
	o/o	o/o	o/o
I	91.3	81.8	9.5
II	87.2	73.0	14.2
III	85.5	77.0	8.5
IV	85.7	73.0	12.7
V	84.2	74.3	9.9
VI	91.8	81.2	10.6
VII			
(a)	87.5	73.0	14.5
(b)	76.7	68.1	8.6
VIII	91.9	80.3	11.6
IX	81.0	68.4	12.6
X	81.3	70.9	10.4
XI	80.9	69.1	11.8
XII	84.9	74.2	10.7
XIII			
(a)	92.6	80.6	12.0
(b)	86.7	75.7	11.0
XIV	98.4[b]	91.0[b]	7.4[a]
XV	92.9	77.1	15.8[b]
XVI	84.2	69.6	14.6
XVII			
(a)	73.6[a]	64.2[a]	9.4
(b)	79.8	66.5	13.3
(c)	86.0	72.3	13.7
XVIII	82.7	71.0	11.7
Weighted mean	86.02	74.43	11.59

[a] Minimum value. [b] Maximum value.
c Unperiodic.

The frequencies of hours of minimum relative humidity are given in table 58, which shows that the minimum value occurs at 13h with the greatest frequency, coinciding with the hour of maximum temperature. An attempt was made to determine the most frequent hour of occurrence of maximum relative humidity, but it was found that the data presented an almost complete scatter. There is slight indication of a maximum frequency at 04h, however; the values at 03h, 04h, 05h, 06h, 07h, and 08h are 24, 41, 31, 36, 28, and 22 cases respectively.

Diurnal Variation of Relative Humidity

General Remarks

As shown in table 59, the diurnal variation of relative humidity is small, as was also found to be the case with sea-surface and air temperatures, and with vapor pressure. On 76 per cent of all days of the cruise, the diurnal variation was less than 15 per cent, certainly an insignificant mean variation when compared with relative-humidity ranges in continental or even insular areas.

Diurnal Variation of Relative Humidity for all Days

It would be expected that the diurnal curve of mean hourly relative humidity would present a mirror image of the curves of vapor pressure and air and sea temperature. Figure 31 demonstrates that this supposition is true in the case of the Carnegie data. There appears to be a well-defined minimum relative humidity at 13h with a less-pronounced maximum at 04h. Comparing the curves of vapor pressure with those of relative humidity, it may be observed that an unusually high value for vapor pressure exists at 04h, which undoubtedly gives a some-

Table 57. Hour of mean maximum and minimum relative humidity, Carnegie, 1928-29

Group	LMT	Mean maximum[a]	LMT	Mean minimum[a]
	h	o/o	h	o/o
I	23	89.0	12	83.9
II	9	83.8	16	77.2
III	7	83.7	14	78.2
IV	4	81.8	11	74.9
V	6	81.1	14	76.5
VI	6	88.5	15, 16	84.4
VII				
(a)	4	83.3	13	75.7
(b)	2	74.9	13	69.7
VIII	1	88.6	12, 13	84.0
IX	20, 21	77.7	11	71.1
X	1	79.1	14	73.6
XI	1	77.4	13	70.7
XII	23	81.2	12	76.2
XIII				
(a)	4	89.5	14	83.7
(b)	4	84.0	10	77.6
XIV	8	96.4	15	92.4
XV	22	86.4	13	80.3
XVI	0	81.2	15	72.4
XVII				
(a)	6	71.9	15	66.4
(b)	3	76.6	11	69.1
(c)	3	82.1	11	78.6
XVIII	2	79.4	12, 15	73.0

[a] Periodic

Table 58. Frequencies of hours of occurrence of minimum relative humidity, Carnegie, 1928-29

Group	Local mean hours																							
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
I	...	...	1	...	1	...	...	...	1	1	3	...	...	...	...	...	...	...	2	4	1	2	...	1
II	...	...	...	1	...	1	...	...	...	1	...	...	...	...	...	...	1	...	...	...	...	...	...	...
III	1	1	...	...	1	2	...	...	1	...	...	1	4	2	4	1	1	2	1	...	...	1	...	...
IV	...	1	...	...	...	...	...	1	1	1	5	4	3	7	5	4	1	2	...	...	...	...	...	...
V	...	...	...	...	...	...	...	...	1	...	...	2	1	2	3	2	1	...	1	1	1	...	...	...
VI	...	...	1	1	1	1	...	1	...	1	3	2	...	...	1	3	2	1	1	1	...	1	...	...
VII																								
(a)	2	2	1	2	1	2	2	3	1	1	3	6	10	10	11	6	5	4	1	...	2	...	...	2
(b)	...	...	1	...	...	...	...	...	1	2	4	4	5	8	3	1	4	2	...	...	...	1	1	1
VIII	1	...	...	1	1	...	...	...	...	...	...	...	2	1	2	3	4	...	...	...	...	...	...	1
IX	1	1	...	...	...	...	...	1	...	...	2	5	4	2	2	1	2	...	2	...	...	...	...	...
X	1	...	...	...	...	...	...	...	...	1	2	3	3	1	2	3	...	2	...	1	...	...	...	...
XI	1	...	1	1	1	1	1	2	1	4	5	7	7	8	7	3	2	...	...	...	...	...	...	...
XII	1	...	...	...	...	...	...	...	...	2	1	1	1	2	3	2	2	1	...	2	1	1	...	1
XIII																								
(a)	...	2	...	1	2	1	...	1	...	...	...	1	2	6	3	4	5	3	2	2	...	1	...	1
(b)	1	...	...	...	...	...	...	1	...	...	...	...	1	2	1	1	...	...	1	...	...	....	...	...
XIV	...	...	...	...	...	...	...	...	...	...	...	1	...	1	...	1	...	1	...	...	...	1	...	...
XV	4	4	...	2	...	...	1	...	1	2	7	6	5	5	3	4	1	2	1	1	2	...	...	...
XVI	...	...	...	...	...	...	...	...	...	...	2	2	4	6	3	5	2	4	1	1	...	...	...	1
Total	13	11	5	9	8	8	4	10	8	16	37	45	52	63	53	44	33	24	13	13	7	8	1	8

Table 59. Frequency distribution of the unperiodic diurnal amplitude of relative humidity, Carnegie, 1928-29

Range in per cent	No. days	Percentage of total	Cumulative percentage	
< 5.0	7	2.3	2.3	100.0
5.0 - 10.0	106	34.7	37.0	97.7
10.0 - 15.0	120	39.2	76.2	63.0
15.0 - 20.0	53	17.3	93.5	23.8
> 20.0	20	6.5	100.0	6.5
Total	306	100.0	.....	.....

Table 60. Mean unperiodic diurnal amplitude of relative humidity for ranges in latitude, Carnegie, 1928-29

Range in latitude	Mean in per cent	No. days	Range in latitude	Mean in per cent	No. days
° °			° °		
>45 N	8	27	5 N- 5 S	11	34
45 N-35 N	12	26	5 S-15 S	12	37
35 N-25 N	12	40	15 S-25 S	12	31
25 N-15 N	12	32	25 S-35 S	14	24
15 N- 5 N	12	46	35 S-45 S	11	9
	Mean and total		.....	12	306

what higher value for relative humidity at this hour. Otherwise we should expect the hour of maximum relative humidity to coincide with the hour of minimum air temperature (05h).

Variation of the Diurnal Amplitude of Relative Humidity with Latitude

Data concerning the variation of the diurnal amplitude of relative humidity by ranges of latitude are shown in table 60. It is an interesting fact that the variability of relative humidity between mean latitudes 10° and 40° north is a constant (12 per cent). Such a result may be partially explained on the basis of the fact that the curves of variability of air temperature (fig. 18) and vapor pressure, according to ranges of latitude, are completely out of phase between these ranges, whereas they tend to approximate the same phases in the Southern Hemisphere.

Effect of Wind on the Diurnal Amplitude of Relative Humidity

As has been done in the cases of air temperature and vapor pressure, the mean unperiodic amplitude of relative humidity has been computed for fifty-two days in tropical regions between latitudes 20° north and 20° south; with a wind force equal to or greater than 4, Beaufort scale, and for fifty-two days with a wind force less than 4. The results give a diurnal amplitude of 9.96 per cent for days with wind force equal to or greater than 4, and one of 12.85 per cent for days with a wind force less than this value. This result compares favorably with the results of similar treatment of air-temperature and vapor-pressure data, that is, higher wind velocities tend to reduce the diurnal amplitudes of all three elements.

Harmonic Analysis of Relative-Humidity Data

As shown in table 61, the amplitudes and phase angles of the 24-hour, 12-hour, and 8-hour terms are extremely irregular between the various groups of Carnegie data, as was also found to be the case with vapor pressure. The time of minimum air temperature and vapor pressure, however, and the time of maximum relative humidity, appear to occur with considerable regularity, the maximum relative humidity occurring between mid-

Table 61. Results of Fourier analyses of diurnal variation of relative humidity for groups, Carnegie, 1928-29

Group	Coefficients					
	a_1	a_2	a_3	b_1	b_2	b_3
	o/o	o/o	o/o	o/o	o/o	o/o
I	+1.57	-0.35	+0.19	+0.20	-0.22	-0.57
II	-0.52	+0.53	+0.38	+1.64	-1.29	+0.10
III	+1.25	-0.41	+0.37	+0.79	-0.80	+0.22
IV	+2.78	-0.75	+0.16	+0.86	+0.37	-0.20
V	+1.44	-0.80	-0.21	+0.27	0.00	+0.22
VI	+0.70	-0.53	-0.13	+0.72	-0.67	+0.06
VII						
(a)	+2.85	-0.89	-0.15	+0.88	+0.50	-0.09
(b)	+1.71	-0.48	+0.09	+1.09	-0.39	+0.18
VIII	+1.74	-0.09	+0.05	+1.00	+0.11	+0.16
IX	+2.70	-0.68	0.00	-0.15	-0.41	-0.25
X	+2.12	-0.53	+0.13	+0.82	-0.35	+0.16
XI	+2.63	-0.65	+0.10	+0.72	+0.37	-0.28
XII	+2.10	-0.60	+0.16	+0.01	-0.22	-0.19
XIII						
(a)	+2.02	-0.73	-0.08	+1.16	-0.18	+0.06
(b)	+1.44	-0.71	-0.33	+0.98	+0.46	-0.92
XIV	+0.87	-0.18	+0.16	+0.86	-0.81	+0.22
XV	+1.87	+0.06	-0.08	+1.18	-0.67	-0.24
XVI	+2.12	-0.36	+0.61	+1.37	-0.66	+0.15
XVII						
(a)	+1.72	-0.45	-0.15	+1.77	-0.75	-0.04
(b)	+3.00	-1.00	+0.16	-0.06	+0.87	+0.15
(c)	+0.82	-0.26	-0.22	+0.60	+0.47	-0.26
XVIII	+2.73	-0.54	+0.13	+1.27	-0.16	-0.09

Group	Amplitudes			Phase angles		
	c_1	c_2	c_3	ϕ_1	ϕ_2	ϕ_3
	o/o	o/o	o/o	°	°	°
I	1.58	0.41	0.60	82.7	237.8	161.6
II	1.72	1.39	0.39	342.4	157.7	75.3
III	1.48	0.90	0.43	57.7	207.1	59.3
IV	2.91	0.84	0.26	72.8	296.3	141.3
V	1.46	0.80	0.30	79.4	270.0	316.6
VI	1.00	0.85	0.14	44.2	218.3	294.8
VII						
(a)	2.98	1.02	0.17	72.8	299.3	239.0
(b)	2.03	0.62	0.20	57.5	230.9	26.6
VIII	2.01	0.14	0.17	60.1	320.7	17.4
IX	2.70	0.79	0.25	93.2	238.9	180.0
X	2.27	0.63	0.21	68.9	236.6	39.1
XI	2.73	0.75	0.30	74.7	299.6	160.4
XII	2.10	0.64	0.25	89.7	249.9	139.9
XIII						
(a)	2.33	0.75	0.10	60.1	256.0	306.9
(b)	1.74	0.85	0.98	55.8	302.9	199.7
XIV	1.22	0.83	0.27	45.3	192.5	36.0
XV	2.21	0.67	0.25	57.7	174.9	198.4
XVI	2.52	0.75	0.63	57.1	208.6	76.2
XVIII						
(a)	2.47	0.87	0.15	44.2	211.0	255.1
(b)	3.00	1.32	0.22	91.1	311.0	46.8
(c)	1.02	0.54	0.34	53.8	331.1	220.2
XVIII	3.01	0.56	0.16	65.1	253.5	124.7

night and 06h. The small diurnal amplitude of relative humidity (1 to 3 per cent) is striking in comparison with the much greater range observed over land.

Variation of Relative Humidity with Sea- and Air-Temperature Differences

The same days used for determining the effect of differences between sea and air temperatures (sea minus air) on vapor pressure have been used to obtain the variation of relative humidity due to these differences. The results of these computations are presented in table 62 and figure 34. These data indicate an asymmetrical variation, since the minimum value for relative humidity occurs within the range (sea minus air temperature) +0.°6 to +1.°0. There is a slight indication that relative humidity tends to increase as the differences between sea and air temperatures increase in either direction

from the minimum value mentioned.

Variation of Relative Humidity with Latitude

The mean values of relative humidity for the various ranges of latitude are presented in figure 32. It may be observed that the values are lowest in the subtropical regions between mean latitudes ±10° and ±30°, and highest at the equator and in higher latitudes. These results are in accord with the conclusions which have been reached through similar treatment of air-temperature and vapor-pressure data, that is, the differences between air temperature and vapor pressure (specific humidity) are greatest within subtropical regions.

Hourly values of the various meterological elements for certain groups of consecutive days have been plotted and two representative diagrams are reproduced as figures 35 and 36. The first is for seven days during February 1929, while the Carnegie was in tropical waters of the South Pacific between longitudes 112° and 126° west. The prevailing weather was cloudy to partly cloudy with easterly winds and moderate sea. The plot of figure 36 is for seven days during July 1929, in the North Pacific between latitudes 38° and 46° north, longitudes 123° and 143° west. The prevailing weather during this period was mostly overcast with frequent rainstorms and much drizzle, fog, and mist. Winds were variable.

The general features of the curves can be read from the figures. Air and sea temperatures show a strong tendency to follow one another. The curve of differences between sea and air temperature correspond closely to the curve of air temperature. There also appears to be a positive correlation between short-period changes (1 to 3 hours) in relative humidity, but an inverse relation for the long-period (seven-day) variation. The closest correlation between differences of sea and air temperatures seems to be with relative humidity or saturation deficit. This was verified by determining the saturation deficit (E - e) for several series of days. Invariably the two curves of sea temperature minus air temperature and saturation deficit followed each other very closely in both short- and long-period variations.

Table 62. Variation of relative humidity with differences between sea and air temperature, Carnegie, 1928-29

Δt (sea - air)	Relative humidity	No. days
°C	o/o	
>+1.0	84.71	16
+0.6 to +1.0	77.81	31
<+0.6	78.31	39
< -0.6	80.99	50
-0.6 to -1.0	86.84	18
> -1.0	91.06	14
Mean and total	83.29	166
Weighted mean	82.58	....

CONCLUSION

The Carnegie data indicate that variations of vapor pressure and relative humidity over the oceans are always small and, in individual instances, highly irregular. Only by examining large quantities of humidity data can significant conclusions be drawn concerning the relations between sea-surface temperature, air temperature, and vapor pressure. Many of the results presented in this chapter, therefore, are to be considered qualitative only, since a sufficient quantity of data is not available to establish the various relations quantitatively. It is quite possible that additional humidity observations over the sea will serve to change some of the views which have been presented here.

EVAPORATION

INSTRUMENTS AND METHODS

Evaporimeter

The rate of evaporation from a pan of sea water was calculated at intervals on board the Carnegie from measurements of the changes in salinity of a sample of sea water. The evaporimeter, a thermometer-right-angle type (Richter and Wiese No. 16), consisted of a copper vessel (fig. 37) within which was fitted a glass container capable of holding 2000 cc of sea water and exposing a surface of 263 cm^2. The whole apparatus was set in gimbals to offset the effects of the natural rolling of the ship. A set of gimbal stands was mounted on each side of the stern near the rail, and by exchanging the evaporimeter and rain gage it was possible to keep the evaporimeter always on the windward side of the vessel.

Supplementary Instruments and Observations

The Assmann psychrometer was used for obtaining wet- and dry-bulb temperatures at the evaporimeter, and a standard Tycos anemometer (DTM No. 4), recording wind speed in feet per minute, was used to determine total wind movement. The thermometers used in the psychrometer were standard instruments, as previously described.

Throughout the duration of each series of measurements the following observations were made at each hour: (1) ship's course and speed; (2) wind speed and direction at the evaporimeter and at the rail; (3) wet- and dry-bulb temperatures at the evaporimeter and at the rail; (4) sea-surface temperature; (5) temperature of the water in the evaporimeter; (6) state of the sea; (7) state of the weather; (8) pitch and roll of the vessel; (9) amount and type of clouds; (10) atmospheric pressure; and (11) the amount of precipitation during the hour. Precipitation was measured in inches by a standard rain gage.

Methods of Determining Salinities

The salinity of the sea-water samples in the evaporimeter was determined by means of the salinity bridge used in oceanographic work, except when the salinity was greater than could be recorded on the scale of the bridge. In such cases, the titration method was used.

The depth (h) of evaporation in millimeters was determined by the following formula from Wüst [37]

$$h = Cs\delta/(S_2 - S_1) \;/\; S_2$$

where δ is the specific volume of distilled water at the mean temperature of the water in the evaporimeter; C is the constant of the vessel, and is equal to the quotient of the volume and the evaporating surface (for the Carnegie data this is 76.05 mm); S_1 and S_2 represent the salinities in parts per mille at the beginning and end of the run; and s is the density of sea water at S_1 and t_1 (beginning temperature). The values of s were obtained from Knudsen's Hydrographical Tables[a].

Actually, for salinities between 30 parts per mille and 40 parts per mille, and for temperatures between -2°.0 and 30°.0, the formula can be simplified by using the value 1.027 for the product of s and δ. The error resulting from the use of this mean value does not amount to more than 2 per cent of the actual value.

The amount of precipitation during the run has been added to the resulting depth of evaporation as determined from these measurements.

Evaluation of Data

Although the observer, Dr. J. H. Paul, chose calm, fair weather in which to carry out the measurements, it was often necessary to discontinue runs when rolling or pitching of the vessel, or vibrations caused by running the main engine, brought about the possibility of water's being splashed from the evaporimeter. Even though every precaution was taken to insure the accuracy of the results, there remains the possibility that, unknown to the observer, water was splashed out of the container or added to that already present by salt spray, dew or spray from the water used in washing down the decks. These seem to be the chief sources of observational errors.

It is possible, however, to calculate the probable inaccuracy of the results due to the accidental addition or subtraction of sea water from the evaporimeter during the run. If it is assumed that the change in height of the water in the vessel owing to the above causes amounts to ±5.0 mm (a generous allowance), then by taking the mean values of S_1 and S_2 as 36 and 40 parts per mille respectively, it is found that

$$h = (263 \times 0.5 \text{ cc}/263 \text{ cm}^2)\ 1.027$$
$$(0.040 - 0.036)/0.040 = \pm 0.5 \text{ mm}$$

This is 6 per cent of the mean value of h (7.8 mm) for a vessel containing exactly 2000 cc of water at the above mean salinities.

Because of these uncertainties, as well as the pressure of carrying out other programs of the Carnegie's work, it became necessary to discontinue the evaporation observations after January 9, 1929.

DISCUSSION

One of the major problems of marine meteorology is that concerning the quantity of water evaporating from the surface of the sea. Consequently, preparations were made before the Carnegie left Washington for determining evaporation rates of sea water from a pan on board the vessel. It was not until July 19, 1928, however, that conditions were obtained which were favorable for beginning these measurements. Between this date and January 9, 1929, a total of twenty-three successful evaporation series were made. Nine of these were made in the North Atlantic Ocean and the remaining number in the southeastern Pacific Ocean. Most of the series were carried through 24 hours; five through 48 hours.

The results of the twenty-three series are presented in table 63. The uncorrected evaporation values range from 2 mm to 10 mm with a mean of 6.22 mm. According to Wüst [38], these values must be reduced by multiplication with the factor 0.53 to represent fairly actual evaporation from the surface of the sea. The mean of the twenty-three Carnegie series corrected in this man-

[a] English edition, Copenhagen (1901)

Table 63. Twenty-four-hour values of sea-water evaporation, Carnegie, 1928-29

Run No.	Dates	Mean Latitude	Mean Longitude	Duration of runs	Mean cloudiness	Mean air temperature at rail	Mean sea-surface temperature	Mean vapor pressure at 3.6 m. (e_a)	Mean vapor pressure at sea-surface (e_w)
	1928	°	°	hrs		°C	°C	mm	mm
1	July 19-20	63.8 N	21.8 W	24	0.9	11.45	11.73	9.1	10.3
2	Aug. 18-19	27.0 N	38.9 W	24	0.7	26.25	26.90	19.5	26.6
3	Aug. 20-21	23.3 N	39.9 W	24	0.6	26.13	26.88	19.0	26.6
4	Aug. 21-22	20.6 N	38.2 W	24	0.5	26.34	26.29	20.3	25.7
5	Aug. 22-23	18.0 N	38.2 W	24	0.7	26.24	26.14	21.6	25.4
6	Aug. 24-25	15.6 N	38.0 W	24	0.3	26.76	26.57	21.6	26.1
7	Aug. 28-29	10.8 N	37.3 W	24	0.7	26.40	27.42	21.4	27.4
8	Aug. 30-31	9.4 N	37.0 W	25	0.7	26.45	27.35	21.5	27.4
9	Aug. 31-Sep. 1	8.0 N	36.1 W	24	0.8	26.56	27.26	21.7	27.2
10	Nov. 9-10	1.5 S	86.3 W	24	0.4	20.17	20.32	14.3	17.9
11	Nov. 10-12	1.9 S	89.3 W	48	0.4	20.67	20.68	13.4	18.3
12	Nov. 12-14	1.5 S	93.3 W	48	0.6	19.65	19.00	13.7	16.5
13	Nov. 14-15	2.1 S	95.0 W	17	0.4	19.80	19.42	14.4	16.9
14	Nov. 19-21	6.6 S	106.6 W	48	0.3	23.02	22.72	15.8	20.7
15	Nov. 27-28	25.6 S	115.5 W	24	0.6	23.03	23.39	16.9	21.6
16	Nov. 28-29	27.4 S	115.2 W	24	0.4	23.17	23.40	15.4	21.6
17	Dec. 3-4	31.6 S	111.8 W	24	0.8	22.45	22.27	15.9	20.1
18	Dec. 5-6	27.5 S	109.1 W	24	0.5	24.42	22.90	16.8	21.0
19	Dec. 18-19	32.3 S	107.6 W	24	0.4	20.47	20.32	13.4	17.9
20	Dec. 22-24	38.9 S	102.6 W	48	1.0	16.74	16.13	13.0	13.7
21	Dec. 26-28	39.7 S	95.9 W	48	0.4	17.03	16.60	12.8	14.1
	1929								
22	Jan. 1-2	32.0 S	88.9 W	25 3/4	0.4	21.18	21.60	12.7	19.4
23	Jan. 5-6	30.0 S	85.9 W	24	0.5	20.68	20.36	14.8	17.9
Means		.....	.....	.....	0.57	22.31	22.42	16.5	20.9

Run. No.	Mean relative humidity	Mean wind speed (u) (m/sec.)	Salinity S_1 o/oo	Salinity S_2 o/oo	Amount evaporated	Rainfall	Total 24-hour evaporation h_1	Corrected values according to Wüst ($h_1 \times .53$)	Calculated after Sverdrup $h=0.149(e_w - e_a)u$
						mm	mm	mm	mm
1	90	3.8	34.83	35.39	1.23	0.76	1.99[a]	1.05	0.68
2	76	4.8	37.02	37.06	0.08	6.60	6.68	3.54	5.07
3	75	5.4	36.97	41.92	9.22	0.38	9.60	5.08	6.10
4	79	6.1	37.00	41.88	9.10	1.02	10.12	5.37	4.89
5	85	4.5	36.63	39.47	5.62	0.51	6.13	3.25	2.54
6	82	1.3	36.28	39.25	5.91	0.00	5.91	3.14	0.87
7	83	1.8	36.13	37.54	2.93	3.05	5.98	3.17	1.61
8	83	5.7	35.46	36.78	2.80	3.81	6.34	3.36	5.01
9	83	5.0	35.44	34.74	-1.57	4.06	2.49	1.32[b]	4.08
10	81	4.0	34.39	37.07	5.06	0.00	5.06	2.69[c]	2.14
11	73	3.2	34.11	43.12	14.62	0.00	7.31	3.88[d]	2.33
12	80	2.4	34.57	39.36	9.50	0.00	4.75	2.52[e]	1.00
13	83	3.1	34.78	35.70	2.01	0.00	2.84	1.50[f]	1.15
14	75	4.3	35.26	45.06	16.99	0.00	8.50	4.50	3.13
15	80	3.8	36.18	39.88	7.25	0.00	7.25	3.83	2.65
16	72	4.2	36.06	41.17	9.69	0.25	9.94	5.26	3.87
17	78	3.2	35.39	38.99	7.21	0.00	7.21	3.82	2.00
18	73	4.7	35.73	37.59	3.86	0.25	4.11	2.16	2.93
19	74	2.3	34.93	37.69	5.72	0.00	5.72	3.03	1.54
20	91	5.2	33.99	37.21	6.76	0.00	3.38	1.79	0.54
21	88	3.6	33.90	37.73	7.93	0.00	3.96	2.10[g]	0.70
22	67	0.4	34.61	37.99	6.95	0.00	6.48	3.43	0.40
23	81	3.0	34.53	37.59	6.36	0.00	6.36	1.51	1.39
Means	79.7	3.73	35.40	38.70	5.32[h]	0.90	6.22	3.30[i]	2.46[i]

[a] Salt spray in air. [b] Evaporimeter not moved on account of spray. [c] Heavy dew during night. [d] Volume of vessel 1791 cc.- [e] Little direct sunshine during run. [f] Vessel upset, sample collected at once. [g] Heavy dew during first night. [h] Weighted mean. [i] Means for days with wind speed > 2.5 m/sec, 3.22 and 2.84.

ner is 3.30 mm. This is greater than the mean determined by Wüst, who gives a value of 2.64 mm as the mean 24-hour depth of evaporation for all oceans.

The maximum corrected 24-hour value (5.37 mm) was measured on August 20-21, 1928, in mean latitude 20°.6 north, mean longitude 38°.9 west; the minimum 24-hour value (1.05 mm) was recorded on July 19-20, 1928, in mean latitude 8°.0 north, mean longitude 36°.1 west.

Careful measurements of wind velocity, vapor pressure, sea-surface temperature, and air temperature were made coincidentally with the evaporation measurements. From these data it is possible to compute theoretical evaporation rates according to recent formulas developed by Sverdrup [39]. For wind measurements and vapor-pressure determinations conducted at a height of 3.6 meters above the sea surface, the following equation is used

$$h = 0.149\ (e_w - e_a)\ u$$

where e_w is the vapor pressure at the immediate sea surface expressed in millimeters, e_a is the vapor pressure at a level 3.6 meters above the surface of the sea and also expressed in millimeters, and u is the mean wind speed expressed in meters per second. As stated, the mean corrected 24-hour evaporation value for the Carnegie data is 3.30 mm. As computed from Sverdrup's equation, this value is 2.46 mm. On eliminating the five measurements conducted during periods when the mean 24-hour wind speed was less than 2.5 meters per second, the corrected Carnegie value is 3.22 mm, whereas the mean as computed after Sverdrup is 2.84 mm, indicating a better agreement for periods with the higher wind velocities. This agreement is all the more remarkable when the uncertainty of evaporation measurements on board ship is considered.

The number of periods of evaporation measurements is too small to determine the variation of evaporation with the various meteorological elements with any degree of certainty. It was found, however, that cloudiness tended to decrease the evaporation rates slightly, obviously by lowering the sea-surface temperatures. The mean for days with an average cloudiness greater than 0.5 is 2.66 mm per 24 hours (corrected value), whereas the mean for days with average cloudiness less than 0.5 is 2.79 mm per 24 hours. This variation is so slight, however, that it can hardly be taken as conclusive.

The most consistent variation appears to exist with air-temperature changes.[a] The Carnegie data show an increasing rate of evaporation with increasing air temperature up to 25°, but the rate decreases for temperatures over 25°, apparently because of the fact that the higher temperatures occurred only in the tropics, where vapor pressures tended to be high also.

Since much of the original Carnegie meteorological data was lost when the vessel burned, it is impossible to present further corrected data on evaporation rates as related to the various meteorological elements.

CONCLUSION

The efforts made to secure accurate evaporation data on board the Carnegie illustrate some of the many difficulties which are encountered in such observational work at sea. The results also emphasize the necessity for detailed observations of humidity and wind gradients over the sea surface. With fragmentary data available, it is difficult to correct the measurements of evaporation from the small container to represent amounts evaporated from the sea surface [40].

[a] Sverdrup's equation indicates that air temperature should be a secondary consideration. Wind speed, vapor pressure and sea-surface temperature are the controlling factors.

MISCELLANEOUS METEOROLOGICAL PHENOMENA

GENERAL REMARKS

The original meteorological program of the Carnegie [41] called for hourly observations of wind direction and speed, and state of the sea and weather, four-hour reports by watch officers of wet- and dry-bulb temperatures and special observations of atmospheric refraction (by dip-of-horizon measurers at 08h, 12h, and 16h, and by sextant observations on the Sun or Venus when these bodies were near the zenith), occurrence of thunder and lightning, cloud forms and amount, dust content of the air, etc. Owing to the loss of the original logbook, however, it has been impossible to study these data in detail and to present separate chapters on each of these elements in this report. Nevertheless, certain data, including those concerning rainfall, thunderstorms, fog, and optical phenomena, have been entered in the log abstract and are included here.

Data on clouds, wind, and state of the sea are available only from the reports of the Greenwich mean noon observations. It is realized that these noon observations are not comparable as between the various regions with respect to local time; therefore, too much emphasis should not be placed on regional variations in these data. It appears desirable, on future expeditions like that of the Carnegie, to record the noon observations according to local time rather than at Greenwich noon.

WIND

As has been explained, the data on wind speed and direction are available only for the observations at Greenwich mean noon, and therefore these data are not strictly comparable as between the various Groups. Wind speed has been reported according to the Beaufort scale of wind force.

Table 64 shows the frequency of occurrence of the various Beaufort numbers for all Groups. It may be mentioned that the wind force was 4 or less on 83.9 per cent of all days of the cruise.

The mean wind force for the various Groups of Carnegie data are presented in table 65, which indicates that wind velocities were highest (4.3) in the Alaskan Peninsula Group for the period between July 4 and 21, 1929, whereas the lowest mean value (2.2) is recorded for the Hawaiian Group for the period between September 9 and 16, 1929.

The mean Beaufort numbers for the various ranges of latitude are given in figure 18. Wind velocities appear to show maxima at mean latitudes 20° south, at the equator, 20° north, and 50° north, and minima at 30° south, 10° south, 10° north, and 30° north. The highest mean velocity (4.1) appears within the range 45° to 55° north.

Data concerning the prevailing wind directions for the various groups are presented in table 66.

Table 64. Wind-speed frequencies of Beaufort numbers at noon (GMT) for all groups, Carnegie, 1928-29

Beaufort No.	No. days	Percentage of total days	Beaufort No.	No. days	Percentage of total days
0	18	4.9	5	42	11.4
1	28	7.6	6	13	3.6
2	52	14.2	7	3	0.8
3	88	24.0	8	1	0.3
4	122	33.2			
		Total ..		367	100.0

STATE OF THE SEA

Data concerning the state of the sea have been reported according to the International Scale, and are presented in this report in a manner similar to that of the wind data (tables 67, 68, and fig. 18). The state of the sea appears to vary directly with wind speed.

RAINFALL

The days on which precipitation was recorded comprise the only data concerning rainfall entered in the ob log abstract. These log entries indicate that precipitation occurred on 112 days during the cruise, or on 34 per cent of the total days. As indicated by the data in table 69, there is considerable variation between the Groups in the percentage of days with rain. This, how-

Table 65. Wind speed: Mean Beaufort numbers at noon (GMT) for groups, Carnegie, 1928-29

Group	Dates	No. days	Mean wind force
	1928		
I	July 29-Aug. 6	9	3.2
II	Aug. 7-10	4	3.8
III	Aug. 11-23	13	3.4
IV	Aug. 24-Sep. 15 [a]	24	2.3
V	Oct. 2-10	9	3.6
VI	Oct. 26-Nov. 6	12	3.4
VII			
(a)	Nov. 7-Dec. 21 [b]	38	3.1
(b)	Feb. 22-28, 1929	7	3.6
VIII	Dec. 22-31 [c]	10	3.4
	1929		
IX	Jan. 1-14	14	2.9
X	Feb. 6-17	12	3.4
XI	Mar. 1-31 [d]	24	2.4
XII	Apr. 22-May 31 [e]	35	3.5
XIII			
(a)	June 1-30 [f]	14	2.4
(b)	July 1-3	3	3.3
XIV	July 4-21 [g]	18	4.3
XV	July 22-28	7	4.1
XVI	Sep. 4-8	5	3.0
XVII			
(a)	Sep. 9-16	8	2.2
(b)	Sep. 17-Oct. 7 [h]	12	3.8
(c)	Oct. 11-25 [i]	16	3.6
XVIII	Oct. 26-Nov. 14	24	2.6
Total and mean		318	3.2

Days omitted as follows: (a) Aug. 25, 26; (b) Dec. 3-12; (c) Dec. 25, 26; (d) Mar. 4, 13-20, 26; (e) May 6, 11, 20-25; (f) June 8-24; (g) Two dates July 14 on crossing 180° meridian; (h) Sep. 20,-Oct. 2; (i) Oct. 18.

Table 66. Frequencies of wind directions at noon (GMT) for groups, Carnegie, 1928-29[a]

Group	Dates	N	NE	E	SE	S	SW	W	NW	Calm	Days
	1928										
I	July 29-Aug. 6	...	3	...	...	...	1	3	2	...	9
II	Aug. 7-10	1	...	1	...	...	1	1	...	...	4
III	Aug. 11-23	...	1	5	1	1	2	3	...	...	13
IV	Aug. 24-Sep. 15	6	2	6	...	2	3	2	1	2	24
V	Oct. 2-10	1	1	6	1	...	...	...	...	...	9
VI	Oct. 26-Nov. 6	...	...	...	...	2	7	1	1	1	12
VII											
(a)	Nov. 7-Dec. 21	2	3	11	8	9	2	1	1	1	38
(b)	Feb. 22-28, 1929	...	...	6	1	...	...	...	...	...	7
VIII	Dec. 22-31	2	1	2	2	1	...	...	2	...	10
	1929										
IX	Jan. 1-14	1	...	...	8	3	...	1	...	1	14
X	Feb. 6-17	...	...	...	6	6	...	...	...	...	12
XI	Mar. 1-31	2	1	10	5	...	...	1	2	3	24
XII	Apr. 22-May 31	...	8	21	3	2	...	...	...	1	35
XIII											
(a)	June 1-30	1	1	2	1	3	1	3	...	2	14
(b)	July 1-3	...	...	...	2	1	...	...	...	...	3
XIV	July 4-21	...	2	...	3	6	2	4	1	...	18
XV	July 22-28	3	...	...	1	...	...	3	...	...	7
XVI	Sep. 4-8	...	...	...	...	1	...	...	4	...	5
XVII											
(a)	Sep. 9-16	...	2	...	1	1	2	...	1	1	8
(b)	Sep. 17-Oct. 7	...	2	7	3	...	...	...	...	...	12
(c)	Oct. 11-25	...	1	4	2	...	4	1	3	1	16
XVIII	Oct. 26-Nov. 14	...	5	4	5	5	...	1	...	4	24
Total		19	33	85	53	43	25	25	18	17	318

[a] From abstract of log.

Table 67. State of sea: Frequencies of International Numbers at noon (GMT) for all groups, Carnegie, 1928-29

International No.	No. days	Percentage of total days	International No.	No. days	Percentage of total days
0	22	6.0	4	83	22.6
1	46	12.5	5	22	6.0
2	76	20.7	6	5	1.4
3	111	30.3	7	2	0.5
		Total ..		367	100.0

ever, is not significant since the number of days spent by the Carnegie within each Group were relatively few.

There is also considerable variation in the percentage of days with precipitation between the ranges of latitude (table 70); the maximum value (40.0 per cent) occurs in the range 5° to 15° north, and, significantly enough, the minimum value (14.8 per cent) occurs in the range 5° to 15° south.

Table 71 indicates that rainfall takes place somewhat more frequently during nocturnal hours, principally before midnight.

THUNDERSTORMS

Real thunderstorms were observed only four times on board the Carnegie. This is not surprising when it is considered that the summer months were spent in each hemisphere. Thunder was recorded on the following dates: (1) October 9, 1928, latitude 11° 23′ north, longi-

Table 68. State of sea: Mean International Numbers at noon (GMT) for groups, Carnegie, 1928-29

Group	Dates	No. days	International Number
	1928		
I	July 29-Aug. 6	9	3.7
II	Aug. 7-10	4	2.8
III	Aug. 11-23	13	2.8
IV	Aug. 24-Sep. 15	24	2.0
V	Oct. 2-10	9	3.1
VI	Oct. 26-Nov. 6	12	3.3
VII			
(a)	Nov. 7-Dec. 21	38	2.8
(b)	Feb. 22-28, 1929	7	3.3
VIII	Dec. 22-31	10	2.4
	1929		
IX	Jan 1-14	14	2.5
X	Feb. 6-17	12	2.8
XI	Mar. 1-31	24	2.0
XII	Apr. 22-May 31	35	3.0
XIII			
(a)	June 1-30	14	2.3
(b)	July 1-3	3	2.3
XIV	July 4-21	18	3.6
XV	July 22-28	7	3.7
XVI	Sep. 4-8	5	2.2
XVII			
(a)	Sep. 9-16	8	1.6
(b)	Sep. 17-Oct.7	12	3.0
(c)	Oct. 11-25	16	2.8
XVIII	Oct. 26-Nov. 14	24	2.0
Total and mean		318	2.7

tude 78° 31′ west; in the afternoon and from 19h to midnight. (2) October 27, 1928, latitude 5° 44′ north, longitude 79° 54′ west; in the morning. (3) October 28, 1928, latitude 4° 15′ north, longitude 79° 39′ west; in the morning. (4) March 26, 1929, latitude 16° 08′ south, longitude 158° 22′ west; in the morning. Lightning was observed on sixteen days during the cruise, or on only 5 per cent of the total days (311). These data are presented in table 72.

Table 69. Frequency of days on which rain occurred for groups, Carnegie, 1928-29 [a]

Group	Dates	No. with rain	No. without rain	Total days
	1928			
I	July 29-Aug. 6	1	8	9
II	Aug. 7-10	1	3	4
III	Aug. 11-23	0	13	13
IV	Aug. 24-Sep. 16	5	19	24
V	Oct. 2-10	3	6	9
VI	Oct. 26-Nov. 6	9	3	12
VII				
(a)	Nov. 7-Dec. 21	11	29	40
(b)	Feb. 22-28, 1929	1	6	7
VIII	Dec. 22-31	1	9	10
	1929			
IX	Jan. 1-14	3	11	14
X	Feb. 6-17	3	9	12
XI	Mar. 1-31	14	11	25
XII	Apr. 22-May 31	17	18	35
XIII				
(a)	June 1-30	5	9	14
(b)	July 1-3	0	3	3
XIV	July 4-21	9	10	19
XV	July 22-28	5	3	8
XVI	Sep. 4-8	1	4	5
XVII				
(a)	Sep. 9-16	1	7	8
(b)	Sep. 17-Oct. 7	6	6	12
(c)	Oct. 11-25	9	7	16
XVIII	Oct. 26-Nov. 14	6	18	24
Total		111	212	323

[a] From abstract of log.

Table 70. Number of days on which rain occurred for ranges in latitude, Carnegie, 1928-29 [a]

Ranges in latitude	Total days	No. without rain	No. with rain	Percentage of total days with rain
° °				
65 N-55 N	19	15	4	21.1
55 N-45 N	41	27	14	34.1
45 N-35 N	43	30	13	30.2
35 N-25 N	43	30	13	30.2
25 N-15 N	36	23	13	36.1
15 N- 5 N	50	30	20	40.0
5 N- 5 S	34	25	9	26.5
5 S-15 S	54	46	8	14.8
15 S-25 S	35	20	15	42.9
25 S-35 S	26	18	8	30.8
35 S-45 S	9	7	2	22.2
Total	390	271	119	.....
Means: All latitudes				29.9
All days				30.5

[a] From abstract of log.

CLOUDS

Data on the number of tenths of sky covered by clouds have been taken from the observations at Greenwich mean noon. Here, again, owing to the variation in local time at which these observations were made, it is not possible to make detailed comparisons.

These cloud data are presented in tables 73 and 74. From table 74 it can be seen that cloudiness is at a maximum at the equator and within the range of latitude 45° to 55° north.

FOG

Data concerning the number of days with fog, and the duration in each instance, are given in table 75. Fog

Table 71. Diurnal variation of rainfall for groups by quarter-day periods, Carnegie, 1928-29

Group	No. quarter-day periods (local mean hours)					Total days
	00-06	06-12	12-18	18-24	00-24	
I	1	1	1	1	4	1
II	0	1	1	0	2	1
III	0	0	0	0	0	0
IV	0	3	0	5	8	5
V	0	1	3	0	4	4
VI	6	8	8	7	29	9
VII						
(a)	6	3	2	7	18	11
(b)	1	0	0	0	1	1
VIII	0	0	1	1	2	1
IX	0	0	1	3	4	3
X	1	1	1	0	3	3
XI	5	2	4	7	18	14
XII	6	5	7	10	28	17
XIII						
(a)	3	1	1	3	8	5
(b)	0	0	0	0	0	0
XIV	7	6	6	8	27	9
XV	4	2	1	3	10	5
XVI	1	0	1	0	2	1
XVII						
(a)	0	1	0	0	1	1
(b)	2	0	3	2	7	6
(c)	6	3	5	7	21	9
XVIII	3	3	4	1	11	6
Total	52	41	50	65	208	112

Table 72. Frequency of days on which lightning was observed, by groups, Carnegie, 1928-29 [a]

Group [b]	Dates	Total days	No. days lightning observed
	1928		
III	Aug. 11-23	13	1
IV	Aug. 24-Sep. 15	22	1
V	Oct. 2-10	9	8
VI	Oct. 26-Nov. 6	12	2
XI	Mar. 1-31	25	3
XII	Apr. 22-May 31	32	1
Total		311	16

[a] From abstract of log.

[b] No days with lightning were recorded in the groups which are not listed above.

Table 73. Mean cloudiness for groups from observations at noon (GMT), Carnegie, 1928-29

Group	Dates	No. days	Mean cloudiness
	1928		
I	July 29-Aug. 6	9	0.79
II	Aug. 7-10	4	0.45
III	Aug. 11-23	13	0.46
IV	Aug. 24-Sep. 15	24	0.52
V	Oct. 2-10	9	0.68
VI	Oct. 26-Nov. 6	12	0.88
VII			
(a)	Nov. 7-Dec. 21	44	0.70
(b)	Feb. 22-28	7	0.53
VIII	Dec. 22-31	10	0.68
	1929		
IX	Jan 1-14	14	0.71
X	Feb. 6-17	12	0.70
XI	Mar. 1-31	24	0.46
XII	Apr. 22-May 31	35	0.43
XIII			
(a)	June 1-30	14	0.69
(b)	July 1-3	3	0.60
XIV	July 4-21	10	1.00
XV	July 22-28	7	0.89
XVI	Sep. 4-8	5	0.90
XVII			
(a)	Sep. 9-16	8	0.54
(b)	Sep. 17-Oct. 7	12	0.36
(c)	Oct. 11-25	15	0.74
XVIII	Oct. 26-Nov. 14	20	0.48
Total and mean		311	0.64

(light to dense) was recorded on sixteen days during the cruise. It is significant to note that all but four of these days were during July 1929, while the Carnegie was in the North Pacific Ocean between Japan and San Francisco.

OPTICAL PHENOMENA

Visibility, solar radiation, halos, coronas, and the blueness of the sky were not included in the observational work of the Carnegie. The optical observations were made incidentally and reported only briefly in the log abstract.

The aurora borealis was observed on three nights during the cruise, namely, on August 3, 4, and 6, 1928, between latitudes 48° and 58° north in the North Atlantic.

Table 74. Mean of cloudiness for ranges in latitude from observations at noon (GMT), Carnegie, 1928-29

Range in latitude	No. days	Mean cloudiness	Range in latitude	No. days	Mean cloudiness
° °			° °		
65 N-55 N	18	0.68	5 N- 5 S	34	0.71
55 N-45 N	36	0.86	5 S-15 S	47	0.48
45 N-35 N	41	0.73	15 S-25 S	33	0.61
35 N-25 N	41	0.57	25 S-35 S	26	0.62
25 N-15 N	33	0.44	35 S-45 S	8	0.65
15 N- 5 N	50	0.61			
Total		.....		367	.....
Means: All latitudes		.....		.....	0.628
All days		.....		.....	0.634

Table 75. Fog reports, Carnegie, 1928-29

Civil date	LMT	Began			
		Position		Temperature	
		Latitude	Longitude	Air	Water
1928	h m	° ′	° ′	°C	°C
May 30	03 00	49 07 N	16 01 W	12.0	13.0
June 4	01 00	50 15 N	12 30 W	13.0	13.0
Aug. 1	03 00	58 21 N	37 14 W	11.5	11.0
Dec. 22	08 00	36 49 S	104 04 W	17.5	17.0
1929					
July 5	15 00	42 47 N	155 58 E	11.0	10.0
July 6	19 30	44 25 N	158 43 E	10.0	9.0
July 9	23 00	47 11 N	167 50 E	7.9	7.4
July 11	23 00	45 14 N	172 36 E	9.0	8.8
July 12	18 40	45 34 N	173 18 E	9.7	9.0
July 13	11 15	46 19 N	174 05 E	11.0	9.0
July 14	14 00	48 13 N	178 32 E	10.2	8.5
July 14	04 00	48 50 N	178 22 W	10.0	8.5
July 15	07 30	50 22 N	173 04 W	9.5	8.5
July 17	18 50	52 33 N	159 54 W	10.0	9.7
July 18	01 00	52 34 N	158 15 W	9.7	9.6
July 28	06 05	38 14 N	123 27 W	12.2	11.5

Table 75. Fog reports, Carnegie, 1928-29--Concluded

Ended						Character of fog
Civil date	LMT	Position		Temperature		
		Latitude	Longitude	Air	Water	
1928	h m	° ′	° ′	°C	°C	
June 1	07 00	50 05 N	13 15 W	13	13	Passing banks light to moderately dense
June 4	12 00	50 16 N	12 05 W	12	13	Moderately dense banks
Aug. 1	18 00	58 13 N	40 04 W	10.0	11.0	Light and in short banks
Dec. 22	18 00	37 12 S	103 55 W	18.0	17.5	Light narrow banks
1929						
July 5	23 00	43 10 N	157 02 E	10.9	10.1	Dense mist to light fog
July 8	15 15	46 59 N	163 27 E	7.5	7.0	Dense mist to light fog
July 9	24 00	47 11 N	167 53 E	8.0	7.5	Light
July 12	09 10	45 11 N	172 53 E	9.5	8.0	Moderately thick
July 12	23 25	45 48 N	173 35 E	9.5	8.8	Thick
July 13	23 30	47 14 N	176 05 E	10.1	8.3	Moderately thick
July 14	19 00	48 25 N	179 35 E	10.0	8.5	Light
July 14	23 00	49 52 N	174 37 W	9.7	8.2	Light
July 15	09 50	50 27 N	172 51 W	10.0	8.7	Light
July 17	23 00	52 34 N	158 45 W	9.5	9.5	Moderate
July 18	11 45	52 34 N	155 41 W	10.5	10.0	Light
July 28	12 50	37 52 N	122 51 W	14.0	12.0	Very thick

SUMMARY

One of the principal objectives of the seventh cruise of the Carnegie was to obtain exact meteorological information from some of the rarely visited areas of the Atlantic and Pacific oceans. For example, from some parts of the South Pacific -- an area approximating that of the United States -- the United States Weather Bureau a few years ago was receiving but one vessel report per year per 3,000,000 square miles. Observations made on vessels such as the Carnegie, therefore, bulk large in the total scientific knowledge of these parts of the earth's surface. As stated by Brooks [41, p. 195]:

"Since there is no prospect for fixed observations over vast stretches of ocean, our knowledge of ocean climatology must be built up by continuing to collect weather data here and there over the oceans wherever and as often as scientific vessels can be sent.... It is perfectly true that observations made with a moving observatory can do no more than note a sample of the climate of each spot passed over. And it is also obvious that unless such samples are recorded now, more next time, and more another time as the vessel passes that way, we shall never have enough of the samples on which to base a general idea of the annual course or ranges of the climatic elements. Each series of samples in itself does not have the value that a corresponding series of depth determinations enjoys, it is true. But that is the nature of what is being observed and does not indicate that this unexcelled opportunity for observing shall not be embraced to the utmost."

From this viewpoint surely the seventh cruise of the Carnegie was important and successful. At the same time it is felt by the writers that the climatological aspects of the cruise are quite secondary when compared with the valuable information gained through the several particular meteorological investigations which were made. Though these findings were only incidental, and their circumstances more casual than deliberate, they are none the less important. The writers have been at pains to call attention in the text to the unusual, the problematical, and the erroneous rather than the usual and expected results. These latter data may be obtained from the tables and figures.

Specifically, these Carnegie results show the need for increasing the accuracy of air-temperature measurements on board ship, and at the same time they illustrate several possible methods for accomplishing this end. In addition, the results demonstrate (1) the need for additional studies of wet- and dry-bulb lapse rates between deck and masthead, (2) the need for further investigations into the relations between sea-surface and air temperatures and humidity, (3) the practical difficulties in conducting evaporation studies at sea with present-day equipment, (4) the necessity for improvement in the dependability of hydrometeorograph equipment, (5) the need for accurate wind, precipitation, and psychrometric observations, and (6) the fallacy in records of the noon observations according to Greenwich meridian time. It is to be hoped that future scientific expeditions to remote parts of the oceans will undertake such programs and profit by the experiences and results which have been set forth in these few chapters.

It is unfortunate that much of the Carnegie meteorological data are in such form that they do not lend themselves to interpretation, and that they cannot, therefore, be embodied in specialized studies. It is only through the study of such material as this, however, that we can gain a knowledge of the difficulties of collecting meteorological data at sea and further expeditions are therefore to be encouraged.

It is to be specifically recommended to future expeditions of this type that they:

1. Be equipped with two or more sets of equipment for measuring and recording air temperature and humidity, to be mounted on opposite sides of the vessel. Only by following such a procedure will it be possible to correct these records for overheating and undercooling of the thermal elements.

2. Record the noon observations at local mean noon

rather than according to Greenwich meridian time.

3. Carry surplus equipment in stock wherever electrical recording apparatus is used.

4. Plan to carry out frequent checks of the recording instruments and obtain periodic psychrometric observations at several heights above the deck of the vessel.

5. Mount several Robinson Cup or Dines anemometers at similar heights above the deck for the purpose of obtaining wind records to correspond to temperature and humidity measurements.

6. Make periodic observations of cloud types and amounts, and estimates of their direction of movement and altitude.

7. Undertake a systematic program of precipitation measurement, preferably with recording equipment.

8. Obtain continuous records of solar and sky radiation.

9. Undertake periodic ascents into the upper atmosphere by means of radio meteorograph equipment.

10. Make periodic counts of dust particles and condensation nuclei in the atmosphere, and determinations of the CO_2 content of the air.

11. Continue investigations of wind velocities and directions at different heights above the sea surface through balloon drifts and cloud motions.

12. Continue evaporation studies at sea with a view toward improving methods and equipment.

It is to be remarked that such a program as outlined above, in addition to the regular program of observations of atmospheric pressure, sea-surface temperature, state of the weather and sea, and optical phenomena, would require the constant attention of several full-time observers. It thus appears that such a program could best be done on a vessel which was primarily equipped for meteorological work, and which would conduct intensive surveys of small areas.

Extensive meteorological and climatological studies could be conducted, as previously, in conjunction with oceanographic or other scientific investigations made over wide areas of the ocean surface.

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APPENDIX I

ABSTRACT OF LOG

ABSTRACT OF LOG

Date	Noon position		Day's run	Current		Remarks
	Latitude	Longitude east		Dir.	Am't.	
Washington, D. C. to Plymouth, England						
Total distance, 3669; time of passage, 29.3 days; average day's run, 125.2 miles						
1928	° ′	° ′	miles	°	miles	
May 1	Washington, D.C.	.....	.....	.....	.....	Left Colonial Beach Steamboat Co. pier under tow at 09h 00m.
2	St. Mary's River	.....	.....	.....	.....	Anchored at entrance St. Mary's River, Chesapeake Bay, at 00h 20m off Kitts Point. Swung ship for declination-observations and deviation. Clear. Light variable breeze.
3	St. Mary's River	.....	.....	.....	.....	Atmospheric-electric observations. Clear. Light NW air.
4	St. Mary's River	.....	.....	.....	.....	Atmospheric-electric observations. Clear. Calm.
5	St. Mary's River	.....	.....	.....	.....	Atmospheric-electric observations. Clear. Calm. Under way 20h 30m with pilot.
6	Newport News	.....	.....	.....	.....	Anchored at 08h 30m. Overcast. Fresh northerly breeze.
7	Newport News	.....	.....	.....	.....	In drydock of Newport News Shipbuilding and Drydock Co. at 10h 10m. Cloudy to clear. Fresh northerly breeze.
8	Newport News	.....	.....	.....	.....	In drydock. Overcast. Rain. Strong NE breeze.
9	Newport News	.....	.....	.....	.....	In drydock. Overcast. Rain. Calm.
10	Newport News	.....	.....	.....	.....	Under way at 13h 15m with pilot. Took departure from Cape Henry at 18h 20m. Gentle SE breeze. Partly cloudy.
11	37 15 N	286 09	134	244	7.5	Clear to cloudy. Smooth to moderate sea. Moderate southerly breeze.
12	38 17 N	291 56	282	61	6.4	Cloudy to overcast. Moderate to choppy sea. Moderate to fresh breeze, S in a.m., NE in p.m.
13	37 43 N	296 37	221	89	69.0	Partly cloudy. Moderate sea and northerly wind.
14	37 00 N	299 40	149	220	44.8	Overcast, rain. Gentle to fresh northerly breeze. Moderate sea.
15	37 04 N	303 24	179	295	30.0	Overcast, rain. Fresh northerly breeze. Choppy sea.
16	37 48 N	306 50	170	231	18.3	Partly cloudy. Moderate to fresh NW breeze. Moderate and broken and choppy sea.
17	38 12 N	310 21	168	225	27.6	Partly cloudy. Moderate sea. Rain squalls. Moderate breeze, NW in a.m., SW in p.m.
18	39 11 N	314 29	202	36	19.8	Cloudy, rain. Strong southerly breeze to moderate gale. Rough sea.
19	40 38 N	318 11	191	16	19.4	Partly cloudy. Fresh southerly breeze. Rough to choppy sea, squalls.
20	42 01 N	321 13	161	337	15.3	Cloudy. Fresh southerly breeze. Moderate choppy sea. Squalls.
21	44 04 N	323 54	170	19	9.2	Cloudy. Moderate southerly breeze. Moderate sea.
22	45 29 N	326 40	146	310	11.5	Cloudy. Moderate sea. Moderate to gentle SE breeze.
23	44 35 N	326 53	54	212	27.2	Overcast. Rain. Moderate to strong NE breeze. Moderate to rough sea.
24	43 51 N	328 18	75	229	10.2	Overcast. Heavy rain. Strong NE breeze to fresh gale. Rough sea.
25	43 13 N	328 30	40	260	31.5	Cloudy. Fresh NE breeze. Moderate sea, broken, and choppy.
26	44 00 N	331 35	144	153	15.4	Cloudy. Fresh northerly breeze. Moderate sea.
27	45 50 N	334 29	164	176	13.3	Cloudy. Fresh NW and SW breezes. Moderate to rough sea.
28	48 11 N	338 52	230	66	14.7	Overcast. Strong northerly breeze to moderate gale. Choppy sea.
29	48 50 N	341 10	101	197	12.4	Clear in p.m. Moderate sea. Moderate southerly breeze.
30	49 37 N	344 24	138	340	4.7	Overcast. Fog. Rain. Moderate southerly breeze and sea.
31	50 23 N	346 29	92	12	2.9	Overcast. Fog. Rain. Moderate sea. Gentle SE breeze.
June 1	50 06 N	346 54	24	42	3.9	Cloudy to overcast. Misty. Moderate sea. Moderate E to SE breeze.
2	49 32 N	347 53	51	289	10.2	Cloudy. Fresh to strong easterly breeze. Moderate to rough sea.
3	50 12 N	347 29	43	159	5.0	Cloudy to overcast. Fog. Rain. Strong to light SE breeze. Choppy sea.
4	50 16 N	347 55	17	160	16.6	Cloudy to overcast. Fog. Rain. Gentle to strong easterly breeze. Choppy sea.
5	49 55 N	348 52	42	4	3.8	Cloudy to overcast. Moderate easterly breeze. Moderate sea. Southerly swell.
6	50 10 N	349 56	44	295	3.1	Cloudy. Squalls. Light to fresh SE breeze. Moderate sea.
7	50 12 N	352 04	82	6	6.3	Cloudy to overcast. Gentle southerly breeze. Rain. Moderate sea.
8	49 59 N	354 57	112	100	1.7	Slightly cloudy in a.m., overcast in p.m. W to SW light winds in a.m. Moderate sea. Rain and strong wind in p.m.
8	Plymouth		.....	.....	.....	Anchored in Plymouth harbor at 20h 30m.
Plymouth, England to Hamburg, Germany						
Total distance, 614 miles; time of passage, 4.1 days; average day's run, 149.8 miles						
1928	° ′	° ′	miles	°	miles	
June 18	Plymouth		.....	.....	.....	Took departure from Plymouth Breakwater at 16h 38m. Cloudy. Moderate sea. Gentle W to SW and S breeze.
19	50 29 N	358 59	126	20	6.3	Overcast. Gentle to moderate SW to W breeze. Smooth to moderate sea.
20	51 39 N	2 24	146	120	15.8	Partly cloudy. Moderate W to NW breeze. Moderate sea.
21	53 23 N	4 24	128	40	12.6	Partly cloudy. Moderate northerly breeze in morning. Gentle southerly breeze in afternoon. Moderate sea.

Plymouth, England to Hamburg, Germany--Concluded

Date	Noon position		Day's run	Current		Remarks
	Latitude	Longitude east		Dir.	Am't.	
1928	° ′	° ′	miles	°	miles	
June 22	Mouth of Elbe River, Germany					
			137	18	6.3	Arrived at Elbe lightship no. 1 at 10h 12m. Overcast. Moderate southerly breeze. Moderate sea.
22	Hamburg		77	....	.....	Picked up pilot at Elbe lightship no. 1. Picked up tug at Altenbruck Towed 54 miles to Hamburg Harbor, Jonas Dock, Vorsetzen. Anchored at 20h 00m.

Hamburg, Germany to Reykjavik, Iceland

Total distance, 1329 miles; time of passage, 13.0 days; average day's run, 102.3 miles

1928	° ′	° ′	miles	°	miles	
July 7	Hamburg		96	....	.....	Left Hamburg Harbor at 07h 00m. Under tow from Harbor to Helgoland. Took departure from Helgoland at 08h 35m July 8. Partly cloudy. Gentle westerly breeze. Moderate sea. Tow distance 96 miles.
8	54 09 N	7 38	5	49	3.0	Partly cloudy. Gentle westerly breeze. Moderate sea.
9	55 21 N	5 13	110	42	9.6	Partly cloudy. Fresh to light WSW breeze. Moderate to smooth sea.
10	58 00 N	2 25	185	56	16.0	Cloudy in morning. Overcast and drizzling in afternoon. Fresh W to SSW breeze. Moderate to choppy sea.
11	60 29 N	0 24	162	67	20.2	Overcast and misty. Fresh W to SW breeze. Moderate to choppy sea.
12	62 16 N	354 59	169	43	14.2	Partly cloudy. Strong SW breeze. Moderate to choppy sea.
13	63 16 N	350 40	133	34	23.2	Partly cloudy. Strong SW breeze. Choppy, rough sea.
14	64 05 N	348 22	79	5	7.2	Cloudy to overcast. Squalls. Strong SW breeze in morning. Very light NE air in afternoon. Rough sea to moderate.
15	63 28 N	345 07	93	337	11.2	Partly cloudy. Light easterly air in morning. Gentle to moderate SW breeze in afternoon. Smooth to moderate sea.
16	63 20 N	342 46	64	31	13.6	Partly cloudy. Moderate westerly breeze. Moderate to choppy sea.
17	62 57 N	341 36	39	84	10.6	Overcast in morning. Rain. Cloudy in afternoon. Moderate westerly and fresh NW breeze. Moderate choppy to rough sea.
18	62 33 N	340 09	46	153	14.4	Cloudy in morning. Overcast and misty in afternoon. Moderate W to NW breeze. Moderate, choppy sea.
19	63 38 N	338 00	87	64	12.8	Overcast. Misty to drizzling. Moderate NW breeze. Moderate sea. Squally.
20	Reykjavik		61	150	16.0	Overcast and drizzling. Gentle westerly breeze. Smooth sea. At anchor in Reykjavik harbor at 08h 00m.

Reykjavik, Iceland to Barbados, B.W.I.

Total distance, 5715 miles; time of passage, 51.8; average day's run, 110.3 miles

1928	° ′	° ′	miles	°	miles	
July 27	Reykjavik		.....	....	.....	Left at 12h 00m with own power. Partly cloudy. Moderate sea and moderate NE to N breeze.
28	62 31 N	333 42	156	154	7	Cloudy in early morning and evening. Clear during day. Moderate sea. Moderate northwesterly breeze.
29	60 40 N	328 45	180	144	14	Cloudy to overcast. Moderate sea. Moderate north breeze.
30	59 17 N	325 45	122	180	14	Overcast in morning. Cloudy in afternoon. Light to moderate N to W breezes. Smooth to choppy sea.
31	57 54 N	325 50	83	72	6	Cloudy to overcast. Moderate to gentle NW to SW breezes. Moderate sea.
Aug. 1	58 15 N	324 10	57	359	15	Fog, mist, and drizzling rain. Overcast. Gentle SW to NW breezes. Moderate sea.
2	58 16 N	321 18	91	153	2	Overcast and misty. Calm to fresh E and NE breezes. Moderate to choppy sea. Squalls.
3	57 52 N	314 27	219	324	4	Aurora borealis in early hours. Cloudy until evening then overcast and misty. Strong NE to E breezes. Choppy to rough sea.
4	54 30 N	310 59	233	292	15	Aurora borealis in late evening. Overcast in morning. Cloudy in afternoon. Strong E to NE breezes. Rough sea. Squalls.
5	51 38 N	310 28	174	244	14	Clouds on horizons. Moderate NE to NW breezes. Moderate sea. Iceberg abeam at 19h 35m.
6	48 26 N	311 51	199	137	12	Cloudy. Moderate WNW breeze. Moderate sea. Aurora borealis in late evening.
7	45 54 N	312 07	153	172	5	Clear during day. Few clouds on horizons in early evening. Moderate to fresh NW to W breeze. Moderate sea.
8	43 14 N	313 06	165	77	9	Cloudy, but principally on horizons. Moderate NW breeze in morning and moderate sea. Gentle NE breeze in afternoon and smooth sea.
9	42 10 N	312 39	67	139	2	Cloudy. Light NE breeze in morning and smooth sea. Moderate to fresh SE breeze and moderate sea in afternoon.
10	39 48 N	311 11	156	343	25	Cloudy to overcast. Rain and mist in middle of day. Fresh to strong SE breeze and rough sea in morning, gentle breeze in afternoon.
11	38 38 N	311 14	70	91	15	Cloudy. Calm to gentle W breeze. Moderate sea.

Reykjavik, Iceland to Barbados, B.W.I.--Concluded

Date	Noon position		Day's run	Current		Remarks
	Latitude	Longitude east		Dir.	Am't.	
1928	° ′	° ′	miles	°	miles	
Aug. 12	36 58 N	311 42	103	157	17	Cloudy on horizons. Light to gentle W and SW breezes. Moderate to smooth sea.
13	36 48 N	313 34	91	85	33	Squalls in early morning. Cloudy on horizons during day. Moderate S to W breezes. Moderate sea.
14	35 14 N	315 41	139	90	16	Cloudy. Squalls in early morning. Moderate SW breeze. Moderate sea.
15	33 36 N	317 45	142	64	15	Cloudy on horizons and occasionally overhead with squalls and lightning. Moderate westerly breeze. Choppy sea.
16	31 10 N	318 56	157	117	23	Cloudy. Squalls in afternoon. Fresh to light W to NW breeze. Moderate sea.
17	29 45 N	319 24	88	160	17	Cloudy. Squalls in early morning. Clear overhead during day. Light to gentle N to E breeze. Smooth sea.
18	27 54 N	320 32	126	264	7	Cloudy on horizons with distant squalls. Gentle to fresh E breeze. Smooth to moderate sea.
19	25 39 N	321 01	137	310	6	Cloudy on horizons. Moderate to gentle SE breeze. Moderate to smooth sea.
20	23 59 N	320 23	105	65	5	Cloudy, with squall conditions. Moderate to fresh breeze in morning, gentle in afternoon. Moderate sea.
21	21 46 N	320 22	134	292	11	Cloudy on horizons. Fresh E breeze. Moderate to choppy sea.
22	19 12 N	321 31	167	255	6	Cloudy. Fresh to moderate E breeze. Moderate sea. Squalls; threatening during day.
23	16 35 N	322 10	162	215	12	Cloudy, chiefly on horizons. Moderate E breeze and moderate sea in morning. Light ENE airs and smooth sea in afternoon and evening.
24	15 48 N	322 03	47	206	20	Cloudy, chiefly on horizons. Calm to light E airs. Smooth sea.
25	14 56 N	321 50	54	218	20	Cloudy. Light ESE breeze in morning; calm thereafter. Smooth sea. Started main engine at 19h 20m.
26	13 55 N	321 58	61	161	2	Cloudy. Light E airs in morning. Light W breeze in afternoon. Smooth sea. Rain in morning and evening. Stopped engine at 08h 10m.
27	13 22 N	322 00	33	184	17	Cloudy, chiefly on horizons. Calm to light west airs. Smooth sea. Started main engine at 19h 25m.
28	11 54 N	322 08	89	184	9	Clear in early morning, cloudy thereafter. Squall in evening. Light W to SW airs and breeze. Smooth sea. Stopped main engine at 08h 00m, and started again at 20h 10m.
29	10 49 N	322 36	70	158	12	Cloudy. Light variable airs, to calm. Smooth sea. Squalls morning and evening. Stopped engine at 05h 55m and started again at 20h 15m.
30	9 28 N	322 52	83	122	10	Cloudy. Calm to light and gentle SW breezes. Smooth to moderate sea. Stopped engine at 11h 20m. Rain at midnight.
31	8 11N	323 52	97	79	17	Squalls throughout day. Gentle to fresh westerly breeze. Moderate to choppy sea.
Sep. 1	9 26 N	323 20	81	57	25	Overcast and raining, morning and evening, otherwise cloudy. Gentle W breeze until evening, then calm. Moderate sea.
2	9 50 N	323 20	24	113	17	Cloudy, chiefly on horizons. Light to moderate westerly breeze. Smooth to moderate sea. Squall at midnight.
3	11 07 N	322 52	82	60	15	Rain morning and evening with lightning in evening. Cloudy during day. Gentle westerly breeze, to calm. Moderate to smooth sea.
4	11 23 N	321 57	57	227	18	Squall in early morning. Cloudy, chiefly on horizons. Light to moderate NE breeze. Smooth to moderate sea.
5	11 33 N	319 10	164	264	18	Cloudy, chiefly on horizons. Moderate to gentle NE breeze. Moderate sea.
6	11 40 N	317 24	105	344	1	Cloudy, chiefly on horizons. Gentle NNE to NxE breeze. Moderate sea. Heavy squall at 19h 00m.
7	11 18 N	315 42	103	202	25	Cloudy, chiefly on horizons. Light NxE breeze to light NNE airs. Moderate to smooth sea. NE swells.
8	11 36 N	314 54	51	296	33	Clear in morning, cloudy in afternoon. Light NE airs to calm. Smooth sea. NE swells.
9	11 45 N	313 53	60	214	12	Cloudy, chiefly on horizons, until evening; then rain squalls. Gentle to light northerly breeze. Moderate sea.
10	12 10 N	312 15	99	257	20	Heavy squalls during morning, cloudy thereafter. Moderate to fresh westerly breeze. Moderate to choppy sea.
11	13 13 N	310 19	130	20	22	Squalls threatening in morning, then cloudy chiefly on horizons. Moderate to light SW breeze. Choppy, moderate sea, calm in evening.
12	13 09 N	309 24	55	257	20	Cloudy, chiefly on horizons. Light ENE airs to light ENE breeze. Moderate sea.
13	13 17 N	307 39	102	305	18	Cloudy, chiefly on horizons. Gentle E breeze. Moderate sea.
14	13 02 N	305 40	117	319	3	Cloudy, chiefly on horizons. Gentle SE breeze. Moderate sea.
15	12 54 N	303 43	115	286	12	Cloudy, chiefly on horizons. Gentle ESE breeze. Moderate sea.
16	13 01 N	301 31	128	329	11	Cloudy, chiefly on horizons. Gentle ExS breeze. Moderate sea. Sighted island at 16h 30m.
17	Carlisle Bay, Barbados		....	....		Partly cloudy. Gentle ExS breeze. Moderate sea. At anchor in Carlisle Bay at 08h 35m.

Barbados, B.W.I. to Balboa, Canal Zone

Total distance, 1361 miles; time of passage, 9.7 days; average day's run, 140.3 miles

Date	Noon position		Day's run	Current		Remarks
	Latitude	Longitude east		Dir.	Am't.	
1928	° ′	° ′	miles	°	miles	
Oct. 1	Barbados		....	....	....	Left anchorage at 11h 30m. Partly cloudy. Moderate sea and gentle NExE breeze.
2	14 41 N	298 37	141	245	17	Near the islands of St. Lucia and Martinique during morning. Cloudy, chiefly on horizons. Moderate sea and moderate to light NE breeze. Lightning in east.
3	14 46 N	296 24	129	277	22	Cloudy in morning, overcast in afternoon, with heavy shower in mid-afternoon. Lightning from NE to NW all day. Moderate to smooth sea. Gentle to moderate NNE to ExS breeze.
4	15 01 N	293 53	147	339	15	Cloudy in morning with lightning in SW in early hours. Overcast and squally during midday, clearing somewhat in afternoon. Moderate sea and moderate to light E breeze.
5	15 19 N	291 47	124	321	18	Partly cloudy. Lightning in NW and N morning and evening. Moderate sea and moderate easterly breeze.
6	15 10 N	288 45	176	303	16	Cloudy during day, clearing in evening. Lightning in NW in early morning. Moderate sea and moderate ESE breeze.
7	14 27 N	285 53	171	277	14	Cloudy, chiefly on horizons. Moderate sea and moderate E breeze.
8	13 34 N	283 31	147	306	37	Partly cloudy in morning. Overcast with rain in mid-afternoon, clearing in evening. Hazy in evening and lightning in S. Moderate sea and moderate to fresh ESE breeze.
9	11 23 N	281 29	177	317	22	Cloudy and hazy in morning. Overcast with rain, thunder and lightning in afternoon. Lightning in evening. Moderate sea and moderate to gentle easterly breeze. Hazy in evening.
10	10 15 N	280 46	81	36	18	Cloudy, with rain squalls, in morning. Cloudy in afternoon and evening. Lightning in SW in evening. Light easterly to SW breezes. Moderate to smooth sea.
11	Colon and Balboa		68	....	....	At anchor in Colon breakwater at 04h 00m. Cloudy all day. Light SxE and S breeze up to 04h 00m. Left Colon anchorage at 11h 00m with tug and docked at Balboa wharf at 19h 30m.

Balboa, Canal Zone to Easter Island

Total distance, 4788 miles; time of passage, 41.9; average day's run, 114.3 miles

1928	° ′	° ′	miles	°	miles	
Oct. 25	Balboa		....	....	....	Left dock at 10h 40m under tow. Ran 10 miles to Taboguilla Light abeam, at 12h 27m. Then took departure. Cloudy and hazy. Moderate sea and moderate NW breeze. Lightning in NW in late evening.
26	6 32 N	279 54	152	222	30	Cloudy in early morning. Overcast after 06h 00m, and all day, with rain squalls. Clear in evening. Moderate NW breeze changing to calm and, in evening to light SE and SW airs and breezes. Moderate to smooth sea.
27	5 44 N	280 06	49	115	3	Cloudy to overcast all day, with occasional short rain squalls. Clearing in evening. Lightning and thunder in east during morning. Gentle to moderate westerly breeze. Moderate sea.
28	4 15 N	280 21	90	86	13	Cloudy to overcast all day, with rain squalls and drizzling rain. Lightning and thunder in morning. Moderate to choppy sea. Variable moderate to light breezes, changing to calm in evening.
29	4 08 N	280 07	15	98	9	Cloudy, chiefly on horizons. Light to moderate southwesterly breezes. Moderate sea. Rain squalls from 16h 45m to 19h 00m.
30	2 53 N	279 52	76	94	16	Cloudy to overcast with occasional rain squalls after 04h 00m, and all day and evening. Moderate SW breeze. Moderate to choppy sea.
31	4 32 N	278 12	140	50	26	Cloudy, with frequent rain squalls throughout 24 hours. Fresh to moderate SW breeze. Choppy to moderate sea. Malpelo Island abeam at 07h 02m.
Nov. 1	6 03 N	277 01	116	76	13	Cloudy, with rain squalls all day. Clearing in evening. Gentle to moderate SW breeze. Moderate sea.
2	4 38 N	277 43	94	128	23	Overcast, with frequent rain squalls throughout 24 hours. Fresh SW breeze changing to light W and SW in evening. Choppy to moderate sea.
3	3 41 N	278 31	75	104	21	Cloudy to overcast. Squally. Rain squalls during morning. Moderate to fresh SW breeze. Moderate to choppy sea. Malpelo Island sighted at daybreak.
4	2 27 N	278 58	77	78	15	Overcast to cloudy. Moderate to gentle SSW to SWxW breezes. Moderate to choppy sea.
5	1 35 N	279 12	54	78	12	Overcast in early morning, clearing somewhat during day. Gentle to light SSW to W breeze. Moderate sea.
6	0 46 N	278 48	55	8	5	Overcast and hazy in early morning. Cloudy, chiefly on horizons, during day. Calm until 10h 00m, then gentle southwesterly breeze. Smooth to moderate sea.
7	0 27 N	277 57	89	192	9	Hazy in early morning. Cloudy until evening, then overcast and

Balboa, Canal Zone to Easter Island--Concluded

Date	Noon position		Day's run	Current		Remarks
	Latitude	Longitude east		Dir.	Am't.	
1928	° ′	° ′	miles	°	miles	
Nov. 7						drizzling. Moderate southwesterly breeze. Moderate sea.
8	1 29 S	277 37	66	247	11	Overcast morning and evening; cloudy during day. Moderate SSW to light S breeze. Choppy to moderate sea.
9	1 19 S	275 05	152	262	16	Overcast in morning, otherwise cloudy chiefly on horizons. Gentle S breeze. Moderate to smooth sea.
10	1 39 S	272 55	131	253	55	Cloudy. Light to moderate S to SxE breeze. Smooth sea.
11	1 53 S	270 55	121	237	34	Cloudy, chiefly on horizons. Gentle to moderate S breeze. Moderate sea. Sighted Galapagos Islands in early p.m.
12	1 16 S	268 41	138	257	28	In vicinity of Galapagos Islands all day. Cloudy, chiefly on horizons. Light to moderate S to SE breeze. Smooth to moderate sea.
13	1 31 S	266 46	116	287	34	Overcast all day, hazy in evening. Gentle to light southeasterly breeze. Moderate to smooth sea. SE swells.
14	1 46 S	265 41	67	287	29	Overcast in early morning, clearing during day, cloudless in evening. Calm, to gentle SSE breeze. Smooth to moderate sea. SE swells.
15	2 30 S	264 15	96	269	12	Overcast in early morning, clearing overhead during the day. Gentle SSE to moderate SE breeze. Smooth to moderate sea.
16	3 04 S	261 44	154	276	10	Drizzling rain at 04h 00m. Cloudy to overcast all day and evening. Gentle to light SExS breeze. Moderate sea. SE swells.
17	3 15 S	260 07	98	280	17	Clear between 04h 00m and 08h 00m, otherwise cloudy. Light to moderate southeasterly breeze. Moderate sea. An unusual meteor appeared in ENE at 04h 45m, stopped at 35 altitude, and faded away.
18	4 01 S	257 20	173	293	22	Clear in very early morning, otherwise cloudy. Moderate to gentle SExS breeze. Moderate sea. SE swells.
19	4 35 S	254 51	152	308	30	Cloudy to overcast in very early morning; thereafter cloudy on horizons. Moderate to fresh SE to ESE breeze. Moderate sea. SE swells.
20	6 57 S	253 08	176	248	18	Clear, changing to cloudy on horizons. Moderate ESE to ExS breeze. Moderate sea.
21	9 14 S	251 34	165	250	15	Cloudy, chiefly on horizons. Moderate to fresh ExS to ESE breeze. Moderate sea.
22	11 57 S	249 45	195	261	14	Cloudy, chiefly on horizons. Fresh ESE breeze. Moderate sea.
23	14 12 S	248 04	167	256	16	Cloudy. Squally in afternoon and evening. Moderate ESE breeze. Moderate sea.
24	16 44 S	246 57	165	259	10	Cloudy and squally all day, with drizzling rain at 19h 00m. Fresh to moderate E to ESE breeze. Choppy sea.
25	19 14 S	245 52	162	252	10	Cloudy, chiefly on horizons. Fresh to moderate easterly breeze. Choppy to moderate sea. Easterly swells.
26	21 42 S	245 34	149	247	14	Cloudy, chiefly on horizons. Moderate to gentle easterly breeze. Moderate sea. Easterly swells.
27	23 20 S	245 13	100	258	10	Squally in early morning, with rain at 01h 00m. Clearing to cloudless in afternoon. Gentle easterly breeze. Moderate sea with easterly swells until noon, then SW and southerly swells.
28	24 48 S	244 35	94	282	15	Cloudy. Gentle to moderate easterly breeze. Moderate sea. Southerly swells.
29	26 36 S	244 40	108	261	16	Cloudy and squally in very early morning; rain at 02h 30m. Cloudy on horizons during day, drizzling rain in late evening. Moderate to gentle ENE breeze. Moderate sea, southerly swells.
30	28 04 S	244 51	89	247	18	Cloudy to overcast with rain squalls during morning, then cloudy to clear. Light to gentle northeasterly breeze. Moderate to smooth sea.
Dec. 1	29 12 S	245 13	70	156	6	Cloudy to clear. Light to gentle northeasterly breeze. Smooth sea.
2	30 34 S	245 44	86	162	7	Cloudy, chiefly on horizons. Light to gentle northeasterly breeze. Smooth sea. Southerly swells.
3	31 32 S	247 16	97	215	6	Overcast in mid-afternoon, otherwise cloudy. Gentle to moderate N to NW breeze. Moderate to smooth sea. Southerly swells.
4	31 23 S	249 56	137	139	16	Cloudy, chiefly on horizons. Squally in late evening. Moderate to fresh NW to WxN breeze. Moderate to choppy sea.
5	28 54 S	251 19	165	76	20	Overcast, with rain squalls in very early morning, then cloudy. Fresh to moderate W to SW breeze. Moderate sea.
6	Easter Island		117	....	....	Sighted Easter Island at 03h 40m. Cloudy. Moderate to light southwesterly breeze. Moderate sea. At anchor in Cook's Bay at 08h 55m.

Easter Island to Callao, Peru

Total distance, 3334 miles; time of passage, 32.9; average day's run, 101.3 miles

1928	° ′	° ′	miles	°	miles	
Dec. 12	Easter Island		....	....	....	Ran 10 miles from anchorage in Cook's Bay, then took departure off Needle and Flat Rocks at 17h 06m. Cloudy. Gentle E to NExE breeze. Moderate sea.

Easter Island to Callao, Peru--Continued

Date	Noon position		Day's run	Current		Remarks
	Latitude	Longitude east		Dir.	Am't.	
1928	° ′	° ′	miles	°	miles	
Dec. 13	28 10 S	250 49	71	....	....	Hazy morning and evening. Cloudy, chiefly on horizons. Light NE to E breezes. Smooth sea. Northeasterly swells, in morning, changing to southwesterly in afternoon and evening. Squally in evening, with rain at 20h 30m.
14	29 22 S	251 07	73	193	21	Clear overhead in early morning, thereafter cloudy to overcast, with occasional rain squalls. Light to gentle E to NE breezes until mid-afternoon, then moderate gale. Smooth to moderate to rough sea. Northeasterly swells.
15	31 08 S	250 29	112	265	17	Cloudy to overcast throughout, with frequent rain squalls. Moderate E gale to strong E breeze, changing in afternoon to fresh southeasterly breeze. Rough to choppy sea.
16	32 02 S	249 06	89	259	8	Cloudy, chiefly on horizons. Moderate to fresh to light southeasterly breezes. Choppy sea. Southeasterly swells.
17	31 45 S	250 35	78	23	12	Cloudy, chiefly on horizons, until evening; then clear. Light to moderate SE to E breezes until early evening, then calm. Moderate to smooth sea. Southeasterly swells.
18	31 53 S	251 02	25	200	10	Cloudless until noon, then cloudy on horizons. Calm to light northerly airs until mid-morning, thereafter moderate northerly breeze. Smooth to moderate sea. Easterly swells in morning.
19	32 27 S	252 37	87	154	8	Cloudy, chiefly on horizons, until evening, then overcast, with drizzling showers. Light to gentle northerly breeze until evening, then moderate northeasterly breeze. Smooth sea until evening, then moderate. Southerly swells.
20	34 03 S	253 18	102	105	13	Cloudy, chiefly on horizons. Hazy in afternoon. Moderate to gentle northeasterly breeze. Moderate sea.
21	35 17 S	254 37	98	218	11	Cloudy, chiefly on horizons, and hazy. Squally in evening. Heavy dew early morning and late evening. Moderate northeasterly breeze. Moderate sea. Southerly and westerly swells.
22	36 51 S	255 55	113	241	9	Overcast and foggy except in early morning and late evening; then cloudy and hazy. Moderate NExN and NE breeze. Moderate sea. Southerly swells.
23	38 40 S	257 06	122	204	22	Overcast to cloudy. Hazy. Moderate northeasterly breeze. Moderate sea.
24	39 54 S	258 59	114	186	17	Cloudy and hazy until noon, thereafter overcast and hazy. Moderate NNE to moderate and gentle N breeze. Moderate sea.
25	40 19 S	261 02	97	166	12	Cloudless in afternoon, otherwise cloudy on horizons. Gentle N to NNW breeze. Moderate sea. Heavy dew in late evening.
26	40 26 S	262 30	68	142	12	A few clouds on horizons, otherwise clear. Calm during morning, otherwise light N to NW airs and breezes. Smooth sea.
27	39 54 S	263 46	66	109	11	Cloudy, chiefly on horizons. Gentle to moderate northwesterly breeze. Smooth to moderate sea. Heavy dew in very early morning.
28	38 26 S	265 52	131	140	12	Cloudy and hazy in morning; overcast and hazy in afternoon and evening, with occasional showers. Moderate westerly breeze until late evening; then light SW breeze changing to calm. Smooth sea.
29	36 38 S	266 55	119	359	10	Overcast and rain in very early morning; calm. Thereafter cloudy, chiefly on horizons, with moderate SE to ESE breeze. Moderate sea.
30	34 32 S	268 10	140	283	13	Cloudy, chiefly on horizons. Moderate ESE to E breezes. Moderate sea. Rain 13h - 14h.
31	32 30 S	269 59	152	265	4	Cloudy in morning; cloudy to overcast thereafter. Moderate southeasterly breeze in morning; calm to light variable airs thereafter. Moderate to smooth sea. SE to SW swells.
1929						
Jan. 1	32 10 S	270 56	52	288	11	Cloudy, chiefly on horizons. Gentle to light SE breeze in early morning, otherwise calm. Smooth sea. Small easterly swells in morning.
2	31 54 S	271 10	21	....	....*	Cloudy, chiefly on horizons. Light southerly airs in morning, changing to northerly in afternoon. Smooth sea.
3	31 55 S	271 45	30	....	....*	Calm until midday. Light northerly airs thereafter. Cloudy, chiefly on horizons. Smooth sea.
4	31 45 S	272 45	53	....	....*	Overcast to cloudy until midday, thereafter clear or only cloudy on horizons. Light northwesterly to southwesterly airs and breezes. Smooth sea.
5	31 02 S	273 25	54	....	....*	Cloudy, chiefly on horizons, until late evening, then rain squalls. Light southwesterly airs in morning, changing to moderate southeasterly in afternoon. Smooth to moderate sea.
6	28 51 S	274 37	146	319	6	Clouds, chiefly on horizons. Moderate to fresh southeasterly breeze. Moderate sea. Overcast and rain squalls in late evening.
7	26 57 S	276 04	137	264	14	Overcast, with squall conditions. Drizzling rain and rain squalls in afternoon and evening. Fresh ESE to SE breeze. Moderate and choppy sea.
8	24 58 S	277 45	150	324	8	Overcast in morning, clear to cloudy in afternoon; overcast in evening. Moderate SE breeze. Moderate sea.

Easter Island to Callao, Peru--Concluded

Date	Noon position		Day's run	Current		Remarks
	Latitude	Longitude east		Dir.	Am't.	
1929	° ′	° ′	miles	°	miles	
Jan. 9	23 06 S	278 45	125	308	12	Overcast. Moderate to gentle SE breeze. Moderate sea.
10	21 27 S	279 33	108	248	13	Overcast, with occasional small breaks in clouds. Moderate to fresh SE breeze. Moderate sea.
11	19 07 S	280 41	152	273	16	Overcast, with occasional small breaks. Moderate to fresh SE to ESE breeze. Moderate sea.
12	16 42 S	281 22	150	298	13	Overcast in morning, cloudy in afternoon. Moderate ESE to SE breeze. Moderate sea.
13	14 06 S	282 08	162	315	12	Overcast in early morning, then clearing to clouds on horizons in afternoon. Moderate southeasterly breeze and moderate sea.
14	12 16 S	282 40	114	274	12	Heavy dew in early morning. Cloudy to clear to overcast during day. Moderate to smooth sea. Gentle southeasterly breeze, changing through light E airs, to calm.
14	Callao		23	....	....	At anchor in Callao harbor at 15h 22m.

*Current data unreliable, as ship's speed insufficient to register on log.

Callao, Peru to Papeete, Tahiti

Total distance, 4470 miles; time of passage, 35.8; average day's run, 124.9 miles

1929	° ′	° ′	miles	°	miles	
Feb. 5	Callao		....	....	....	Left anchorage in Callao harbor at 15h 20m. Ran 7 miles to San Lorenzo Island abeam at 16h 32m; then took departure. Cloudiness 7 to 8. Light southwesterly breeze. Smooth sea. Hazy.
6	11 54 S	281 20	89	....	....	Cloudiness 3 to 7, and hazy. Gentle S to SE breeze. Moderate sea. Light dew in early morning and late evening.
7	10 09 S	280 02	129	329	20	Cloudiness 1 to 5, chiefly on horizons. Gentle southeasterly breeze. Moderate sea. Hazy in afternoon.
8	9 57 S	277 45	136	336	15	Cloudiness 3 to 7, chiefly on horizons. Moderate S to SSE breeze. Moderate sea. Hazy in early morning.
9	10 26 S	275 45	122	310	8	Clouds 7 in morning. Clouds 1, on horizons, in afternoon. Moderate southeasterly breeze in morning to light southerly airs in afternoon. Moderate to smooth sea.
10	10 45 S	275 02	46	257	9	Cloudiness 1 to 8, chiefly on horizons. Light southerly airs in morning and evening; calm during day. Smooth sea.
11	10 39 S	274 06	56	279	8	Nearly overcast before 08h 00m, otherwise cloudiness 1 to 2 only on horizons. Gentle to light S to SE breezes. Smooth sea. Southerly swell.
12	11 00 S	272 32	94	330	9	Cloudiness 2 to 4, chiefly on horizons. Moderate S to SE breeze. Moderate sea.
13	12 33 S	270 18	161	302	9	Cloudy to overcast after early morning hours; a few clouds on horizons before 04h 00m. Moderate to fresh SE breeze. Moderate sea.
14	14 23 S	267 45	185	255	16	Partly cloudy, amount 2 to 5, except just before noon; then nearly overcast. Fresh to moderate SE breeze. Moderate sea.
15	15 49 S	265 06	175	287	12	Cloudy to overcast, amount 9 to 10, up to noon. Squally. Drizzling rain at 07h 00m. Clearing overhead after midday, clouds 2 to 5. Hazy. Moderate SE to E breeze. Moderate sea.
16	15 16 S	262 23	161	305	5	Cloudiness 3 to 8 in morning; 8 to 10 in afternoon and evening. Moderate ESE to ExS breezes. Moderate sea. Hazy.
17	14 46 S	259 14	186	273	7	Cloudiness 6 to 9 in morning; clearing somewhat in afternoon with cloudiness 2 to 5. Moderate to fresh easterly breeze. Moderate sea. Short drizzling rain at 05h 00m.
18	14 19 S	256 41	150	273	3	Cloudiness 1 to 7; hazy. Moderate E and ExS breeze. Moderate sea.
19	13 34 S	254 07	156	291	5	Cloudiness 2 to 3, on horizons. Moderate ExS and ESE breezes. Moderate sea.
20	13 00 S	251 51	137	283	6	Cloudiness 2 to 5, on horizons, until late evening, then clouding over to amount 9. Moderate ESE to gentle ExS breeze. Moderate sea.
21	12 31 S	249 53	119	124	3	Cloudiness 2 to 7, chiefly on horizons. Gentle to moderate easterly breeze. Moderate sea.
22	12 36 S	247 40	130	196	3	Cloudiness 3 to 6, chiefly on horizons. Moderate easterly breeze. Moderate sea.
23	12 31 S	244 50	166	357	4	Cloudiness 5 to 6, chiefly on horizons. Moderate easterly breeze. Moderate sea.
24	12 41 S	242 27	140	261	6	Cloudy and partly cloudy; amounts 1 to 8. Moderate to gentle E to NE breezes. Moderate sea.
25	12 46 S	240 36	109	122	4	Cloudiness 2 to 5, chiefly on horizons, until evening, then almost overcast. Gentle to moderate ENE to E breezes. Moderate sea.
26	13 03 S	238 42	114	319	3	Cloudiness 9 to 4. Gentle to moderate easterly breeze. Moderate sea. Easterly swell.
27	13 28 S	235 50	169	236	8	Drizzling rain and a rain squall between 01h 00m and 03h 00m. Cloudiness thereafter 1 to 5, chiefly on horizons. Moderate sea. Fresh to moderate ENE to E breezes.

Callao, Peru to Papeete, Tahiti--Concluded

Date	Noon position		Day's run	Current		Remarks
	Latitude	Longitude east		Dir.	Am't.	
1929	° ′	° ′	miles	°	miles	
Feb. 28	14 52 S	233 50	143	282	10	Cloudiness 3 to 9. Moderate easterly breeze. Moderate sea.
Mar. 1	16 33 S	231 56	149	303	5	Cloudiness 1 to 4, chiefly on horizons. Moderate to gentle easterly breeze. Moderate sea.
2	17 01 S	230 13	102	108	3	Clear to cloudiness 1 to 4. Gentle easterly breeze. Moderate sea.
3	17 07 S	228 18	111	141	5	Cloudiness 1 to 2, on horizons. Gentle easterly breeze. Moderate sea. Easterly swells.
4	17 12 S	226 39	94	122	8	Cloudiness 1 to 5, chiefly on horizons. Gentle E to SE breezes. Moderate sea.
5	17 05 S	224 37	117	335	4	Cloudiness 2 to 4, chiefly on horizons. Gentle ESE to ENE breezes. Moderate sea. Northeasterly swells.
6	17 13 S	223 22	72	199	2	Cloudiness 1 to 4, chiefly on horizons, except in early evening, then cloudiness 9. Light northeasterly breezes to airs in morning; calm in afternoon. Started engine at noon. Smooth sea. Rain squall at 01h 30m.
7	17 24 S	221 07	129	195	5	Sighted Tatakoto Island at 05h 30m. Cloudiness 2 to 6, chiefly on horizons. Calm until late afternoon, then light SSE airs. Smooth sea. Hazy. Engine running.
8	17 48 S	219 11	113	....	....	Sighted Amanu Island at 05h 15m. Cloudiness 1 to 6, chiefly on horizons. Light SE airs in morning. Light ESE breeze in afternoon. Smooth sea. Ship hove to from 08h 30m until 16h 00m while scientific staff ashore. Running with engine, until 17h 10m.
9	17 36 S	217 58	71	....	....	Cloudiness 2 to 5 until noon, 8 to 9 after noon. Gentle to light easterly breezes. Smooth sea. Started engine at 20h 00m. Hazy in evening.
10	18 02 S	215 55	119	167	4	Cloudiness 1 to 10; overcast and squally in afternoon. Rain from 18h 00m to 20h 00m. Variable NE to SE breezes. Smooth to moderate sea. Stopped engine at 07h 10m.
11	18 05 S	214 20	90	189	1	Cloudiness 8 to 10; squally. Rain squalls in mid-afternoon. Gentle northwesterly breezes until 20h 00m, then calm. Running engine after 15h 47m. Smooth to moderate sea.
12	17 51 S	211 59	135	270	1	Cloudiness 6 to 10; squally. Lightning in SE in early morning. Light showers before 05h 00m. Mehetia Island abeam and distant 2 miles at noon. Gentle northwesterly breezes. Smooth to moderate sea. Heavy rain squalls during evening. Engine running.
13	Papeete		95	....	....	Cloudiness 10; squally. Light NW airs to calm to light E airs. Smooth sea. At anchor in Papeete harbor at 09h 55m.

Note: cloud amounts expressed in scale from 0 for cloudless to 10 for overcast.

Papeete, Tahiti to Pago Pago, Samoa

Total distance, 1274 miles; time of passage, 12.2; average day's run, 104.4 miles

1929	° ′	° ′	miles	°	miles	
Mar. 20	Papeete		....	....	....	Left anchorage in Papeete harbor under own power at 03h 35m. Ran 3 miles, then took departure at 04h 33m. Cloudiness 8 and 9. Rain squalls in evening. Moderate to gentle easterly breeze. Moderate sea. Southeasterly swells.
21	16 46 S	209 16	78	....	....	Cloudiness 2 in very early morning; thereafter 6 to 9, with rain squalls in late afternoon. Gentle to light northerly and westerly breezes. Southeasterly swells. Started engine at 05h 55m, stopped at 08h 00m.
22	17 36 S	208 15	77	136	6	Cloudiness 7 to 9 with rain squalls during morning, otherwise cloudiness 2 to 4, chiefly on horizons. Moderate northwesterly breezes in morning; light westerly airs in afternoon. Moderate, choppy sea. Started engine at 20h 00m.
23	17 10 S	207 19	60	26	2	Cloudiness 1 to 3, on horizons. Light westerly to easterly airs, to calm. Stopped engine at 08h 00m, started at 12h 37m, stopped at 15h 45m. Smooth sea.
24	16 54 S	206 20	59	329	7	Cloudiness 2 to 5 before noon, 5 to 8 after noon. Rain squalls in late evening. Light, to gentle, to moderate easterly breeze. Smooth sea until evening, then moderate.
25	16 32 S	203 59	137	252	7	Cloudiness 7 to 10 with lightning in NE and NW in early morning and in evening. Moderate to gentle easterly breeze. Rain squalls in evening. Moderate sea.
26	16 08 S	201 38	138	157	9	Cloudiness 5 to 9, with rain squalls at intervals throughout 24 hours. Moderate E and ExN breeze. Moderate sea. Thunder in morning.
27	15 42 S	199 26	129	240	2	Cloudiness 5 to 10, with rain squalls in very early hours and threatening all day. Variable light to moderate E to N breezes. Moderate to broken sea.
28	15 32 S	198 00	84	180	7	Overcast in morning, with rain squalls very early. Cloudiness 5 to 7 in afternoon, 4 to 2 in evening. Gentle to light E breezes until evening, then calm. Moderate to smooth sea. Started engine at 21h 12m.

Papeete, Tahiti to Pago Pago, Samoa--Concluded

Date	Noon position		Day's run	Current		Remarks
	Latitude	Longitude east		Dir.	Am't.	
1929	° ′	° ′	miles	°	miles	
Mar. 29	15 16 S	196 40	79	270	4	Cloudiness 2 to 4, chiefly on horizons. Calm to light variable airs. Smooth sea. Engine running.
30	14 42 S	194 20	139	341	6	Cloudiness 3 to 6, with rain squalls in afternoon. Calm, or light variable airs. Smooth sea. Engine running.
31	14 41 S	192 07	129	294	2	Cloudiness 5 to 8 until late evening, then cloudiness 2. Rain squalls in early evening. Calm in early morning, changing to light and gentle northerly breezes in forenoon and, in afternoon, to light westerly breezes. Smooth sea. Engine running.
Apr. 1	14 26 S	189 58	125	233	8	Sighted Manua Islands at 03h 00m. Cloudiness 3 to 6. Light to gentle northwesterly breezes. Smooth sea. Engine running.
1	Pago Pago		40	....	....	At anchor in Pago Pago harbor at 19h 33m.

Pago Pago, Samoa to Apia, Western Samoa

1929	° ′	° ′	miles	°	miles	
Apr. 5	Pago Pago		....	....	....	Left Pago Pago harbor under own power at 14h 10m. Light SW to W breezes until evening, then calm. Moderate to smooth sea. Cloudiness 3 to 4, chiefly on horizons. Engine running.
6	Apia		80	....	....	Cloudiness 3. Hazy. Light W airs, to calm. Smooth sea. Engine running. At anchor in Apia harbor at 08h 15m.

Apia, Western Samoa to Guam, Marianas Islands

Total distance, 3914 miles; time of passage, 28.8; average day's run, 135.9 miles

1929	° ′	° ′	miles	°	miles	
Apr. 20	Apia		....	....	....	Let go moorings in Apia harbor at 11h 25m. Took departure at 11h 35m. Shut down engine at 13h 13m. Cloudiness 6 to 4. Light northwesterly breeze in early afternoon, changing through calm to light northeasterly airs and breezes in late afternoon and evening. Smooth sea.
21	13 07 S	188 12	42	312	8	Cloudiness 4 to 6. Gentle easterly breeze. Smooth to moderate sea. Found two stowaways on board at 08h 00m. Returned to Apia and transferred stowaways to harbor tug at 18h 45m.
22	12 44 S	188 23	25	260	9	Cloudiness 3 in very early morning on horizons, increasing to 8 by noon. Overcast in afternoon and until late evening. Gentle to moderate easterly breeze until mid-afternoon, then varying between moderate breeze and calm. Rain squalls in afternoon and evening Hazy in late evening.
23	11 20 S	188 24	83	254	10	Cloudiness 5 to 7 in morning, 4 in afternoon, chiefly on horizons. Moderate to fresh E to SE breezes. Moderate sea.
24	8 40 S	188 57	164	321	21	Cloudiness 4 to 7 in morning, 2 to 5 in afternoon. Easterly breeze, moderate in morning, gentle to light in afternoon. Moderate sea until late evening, then smooth with easterly swells. Rain squalls at 11h 30m and 14h 00m.
25	7 39 S	188 11	76	272	16	Cloudiness 8 to 9 in morning, with occasional rain squalls before 06h 30m. Cloudiness 6 to 4 in afternoon and 10 in late evening, with rain squall at 21h 45m. Light northerly airs to calm in morning; light NE breeze in afternoon. Smooth sea. Easterly swells. Hazy and misty during day. Engine running.
26	6 44 S	187 35	65	244	17	Cloudiness 8 and 9 in morning and evening, 4 to 6 during day. Light northerly airs to calm. Smooth sea. Easterly swells. Squally in evening. Engine running.
27	5 08 S	187 37	96	194	11	Cloudiness 3 in early morning, 5 and 6 during day, 8 in evening. Calm in morning, light NW airs and breezes in afternoon, calm in evening. Smooth sea. Squally and hazy in mid-afternoon. Engine running
28	3 47 S	187 19	83	260	14	Cloudless and calm until 05h 00m, thereafter cloudiness 4 and 3 and northeasterly breeze, increasing through day from light, in early morning, to moderate in evening. Smooth to moderate sea. Engine running.
29	1 46 S	186 31	130	272	16	Cloudiness 3 and 4, only on horizons, until noon, increasing after noon to 9 in late evening. Gentle to moderate E to NE breezes. Moderate sea. Rain squalls at 22h 50m and 23h 40m.
30	0 22 N	185 58	135	283	12	Cloudiness 4 in early morning, decreasing to cloudless in mid-afternoon, then increasing to overcast in late evening. Fresh to moderate E to NE breezes. Moderate sea.
May 1	2 30 N	184 54	144	336	10	Cloudiness 5 to 8 in morning, 4 thereafter. Gentle to moderate to fresh northeasterly breezes. Moderate to choppy sea. Rain squalls at intervals from early morning to late evening.
2	4 22 N	183 37	136	166	6	Cloudiness 4 in early morning, thereafter 8 to 10, with rain squalls during morning and heavy showers between 16h 00m and 18h 30m. Hazy all day. Fresh to moderate northeasterly breezes. Choppy sea.

Apia, Western Samoa to Guam, Marianas Islands--Concluded

Date	Noon position		Day's run	Current		Remarks
	Latitude	Longitude east		Dir.	Am't.	
1929	° ′	° ′	miles	°	miles	
May 3	6 29 N	182 16	149	231	4	Cloudiness 8 to 10 until late evening, then 6. Squally in morning. Rain squalls at 13h 30m, 15h 32m, 20h 45m. Fresh to moderate NE breeze. Moderate and choppy sea.
4	8 10 N	181 07	122	258	10	Cloudiness very variable, ranging in amount from 4 to 9. Rain squalls at 14h 15m, 15h 00m, and 18h 15m. Moderate to fresh northeasterly breeze. Moderate sea. Hazy.
5	10 47 N	179 26	185	259	20	Cloudiness 6 in early morning, thereafter 4. Squall conditions all day, with rain squall at 16h 50m. Fresh to strong northeasterly breeze. Choppy sea.
6	.....	.....	....	....	....	Omitted, because the 180th meridian was crossed.
7	13 31 N	177 20	205	269	26	Cloudiness 3 to 6. Light rain at 04h 00m. Strong ENE breeze in early morning, changing during day through fresh to moderate in evening. Squally in afternoon. Hazy in evening. Choppy sea.
8	15 23 N	174 43	194	253	12	Cloudiness 3 to 4, chiefly on horizons, until noon, 9 in early afternoon, and 4 to 5 thereafter. Rainsquall at 22h 10m. Moderate to fresh NE to ENE breezes. Moderate sea.
9	16 28 N	171 49	179	232	10	Cloudiness 5 to 3, chiefly on horizons. Fresh NExE and ENE breezes. Choppy, moderate sea. Squally in evening, with drizzling rain at 22h 10m. Hazy. NE swells.
10	18 29 N	169 00	202	215	13	Cloudiness 10 in early morning, clearing to 3 by mid-morning, clouding over to 8 before noon and clearing to 3 in late afternoon. Squally in early morning. Fresh to moderate NExE and ENE breeze. Choppy to moderate sea. Hazy in afternoon.
11	19 19 N	166 24	156	218	7	Cloudiness 2 to 4 in morning, 7 to 2 after noon, chiefly on horizons. Moderate ENE breeze. Moderate sea. Sighted Wake Island at 08h 00m. Hazy in early morning.
12	20 17 N	163 40	165	348	3	Cloudiness 3 to 10 up to noon and 6 to 3 thereafter. Moderate to gentle ENE and NExE breezes. Moderate sea. Light rain at 03h 05m and squally during morning.
13	20 13 N	161 08	142	244	12	Cloudiness 2 to 7 in morning and 4 to 2 in afternoon, chiefly on horizons. Moderate northeasterly breeze. Moderate sea.
14	19 30 N	158 27	158	292	12	Cloudiness 3 to 5, chiefly on horizons. Gentle to fresh ExS breeze. Moderate sea.
15	18 39 N	156 02	145	313	12	Cloudiness 4 to 9 during morning, 3 to 5 after noon, chiefly on horizons. Gentle to moderate ExS and SExS breezes. Moderate sea. Horizons hazy in early morning. Lightning in S in early morning. Rain squall at 10h 30m.
16	17 28 N	153 25	165	316	20	Cloudiness 1 in early morning, thereafter 5 to 6. Moderate ExS to SExS breezes. Moderate sea. Heavy rain at 23h 20m.
17	16 08 N	150 52	166	297	14	Cloudiness 5 to 9 except for few hours in mid-afternoon, when practically cloudless. Squally in very early morning. Moderate to fresh ExS to SE breezes. Moderate sea.
18	14 54 N	148 12	171	328	23	Cloudiness 2 in early morning; increasing amount of thin clouds to 9 by noon; thereafter cloudiness 8 to 10. Moderate ExS and E breezes. Moderate sea.
19	14 02 N	145 56	142	276	8	Cloudiness, chiefly on horizons, 3 to 8 in morning, 3 to 5 after noon. Moderate to gentle E breezes. Moderate sea. Sighted Rota Island at 09h 00m and Guam at 17h 00m. Hazy in morning and evening.
20	Port Apra, Guam		89	....	....	Cloudiness 3 in early morning. Light southeasterly breeze. Smooth sea. Started engine at 05h 50m outside Port Apra. Pilot aboard at 06h 00m. Moored in Port Apra at 08h 00m.

Port Apra, Guam to Yokohama, Japan

Total distance, 1447 miles; time of passage, 13.2; average day's run, 109.6 miles

1929	° ′	° ′	miles	°	miles	
May 25	Port Apra		....	....	....	Let go moorings at 13h 45m, ran one mile under own power, and took departure at 14h 08m. Cloudiness 4 and 5, chiefly on horizons. Moderate ENE breeze. Moderate sea.
26	16 05 N	144 07	161	289	9	Cloudiness 2 to 5, chiefly on horizons, except in mid-afternoon, when cloudless. Moderate ENE to E breezes. Moderate sea. Rain at 01h 45m.
27	18 33 N	143 59	148	262	8	Cloudiness 6 to 1, chiefly on horizons. Moderate E breeze. Moderate sea. Drizzling rain at 04h 25m.
28	21 31 N	144 13	179	334	7	Cloudiness 1 to 5, chiefly on horizons. Moderate to gentle easterly breeze. Moderate to smooth sea.
29	23 26 N	144 05	115	323	10	Cloudiness 7 in very early morning, decreasing through day to 1 in late evening. Gentle to moderate E to SE breezes, until mid-afternoon, then southeasterly light breezes to light airs. Squally in early morning with rain at 00h 05m. Light dew in evening. Running with engine after 19h 23m.

Port Apra, Guam to Yokohama, Japan--Concluded

Date	Noon position		Day's run	Current		Remarks
	Latitude	Longitude east		Dir.	Am't.	
1929	° ′	° ′	miles	°	miles	
May 30	25 15 N	144 09	109	228	15	Cloudiness, chiefly on horizons, 4 to 6 before noon, 3 to 4 after noon. Calm in very early morning, then light to gentle southeasterly breezes. Squally in early morning. Hazy in morning and evening. Smooth sea. Stopped engine at 07h 05m.
31	26 24 N	144 25	71	152	14	Cloudiness 4 to 8 until mid-afternoon, thereafter 2 on horizons. Gentle S breeze decreasing in force to light airs in afternoon and evening. Smooth sea. Heavy dew in morning, light in evening. Engine started 18h 00m.
June 1	28 29 N	144 00	127	298	3	Cloudiness 6 to 10. Light southerly breezes in early morning, increasing in force to strong in late evening. Smooth sea in morning, changing through day to rough in late evening. Heavy dew in morning. Rain at 23h 45m. Engine stopped 06h 00m.
2	30 10 N	143 56	101	132	14	Overcast before noon, thereafter cloudiness 7 to 9. Hazy all day. Fresh SWxW breeze until mid-morning, changing to moderate westerly breeze and decreasing in force through afternoon to calm in late evening. Choppy, moderate sea. Started engine midnight.
3	31 03 N	144 18	57	63	18	Cloudiness 8 to 10 until late evening, then 6. Very hazy all day. Light westerly airs in early morning, increasing in force to moderate in evening. Choppy, moderate sea. Northwesterly swells in early morning. Started engine at 12h 10m. Stopped engine 08h 00m.
4	32 42 N	142 13	145	307	21	Cloudiness 8 to 10 until late evening, then 5. Moderate to fresh southwesterly breezes. Choppy, moderate sea. Hazy all day. Southwesterly and westerly swells. Stopped engine at 05h 38m. Started engine at 15h 00m.
5	33 57 N	141 12	91	30	15	Cloudiness 4 in very early morning, thereafter 8 to 10. Gentle to moderate W to SW breezes. Moderate sea. Hazy all day. Westerly and northerly swells. Sighted Miyake Island at 18h 30m. Saw reflected ray from Nojima Zaki Lighthouse (SE Japan) during evening. Stopped engine at 15h 55m. Drizzling rain after 23h 06m, with rapidly falling barometer. Started engine at 17h 20m.
6	34 52 N	140 39	61	44	38	Overcast in morning, with drizzling rain in early morning; cloudiness decreasing after noon to 3 in evening. Moderate southerly breezes in early morning increasing in force to fresh gale by midday and decreasing to moderate breeze in evening. Rough sea. Stopped engine at 02h 00m, started at 04h 45m, stopped at 09h 45m and hove to on southern edge of typhoon.
7	Yokohama		82	....	....	Overcast all day, and hazy. Gentle to fresh NE breeze after 01h 30m. Moderate sea. Got under way with sails at 01h 35m. Started engine at 10h 55m and ran in to Yokohama harbor. Anchored outside breakwater at 19h 45m.

Yokohama, Japan to San Francisco, U.S.A.

Total distance, 4839 miles; time of passage, 34.9; average day's run, 138.7 miles

11929	° ′	° ′	miles	°	miles	
June 24	Yokohama		....	....	....	Took departure from Honmoku Buoy, Yokohama harbor, under own power, at noon and ran 33 miles to entrance to outer bay at 17h 50m. Overcast, hazy, rainsqualls. Gentle to moderate northeasterly breezes. Smooth to moderate sea. Easterly swells in late evening.
25	34 44 N	141 04	98	66	44	Overcast and drizzling in early hours, clearing to amount 7 by noon and to amount 4 by late evening. Hazy all day. Calm in early morning, changing to gentle easterly breezes before 06h 00m. Moderate sea.
26	36 00 N	142 05	91	47	42	Cloudiness 4 in early morning, increasing steadily to overcast by noon; thereafter overcast. Hazy throughout. Light ESE airs and breezes up to noon, thereafter light SSE breezes. Smooth sea. Heavy dew in morning, light dew in evening. Southeasterly swells.
27	36 41 N	143 38	85	33	9	Cloudiness 4 on horizons in early morning and late evening, otherwise overcast. Hazy throughout. Gentle to light SSE breezes during morning, changing through S to SSW by mid-afternoon. Light airs to calm after 15h 00m. Smooth sea. Swung ship for declination in afternoon.
28	36 46 N	145 23	85	237	4	Hazy throughout. Cloudiness 7 to 9 throughout. Heavy dew in early morning. Calm until 08h 00m, thereafter light easterly airs and breezes. Swung ship for horizontal intensity and inclination from 09h 00m to 19h 00m. Smooth sea.
29	37 45 N	145 27	59	294	18	Cloudiness 9 to 10 (overcast) throughout. Hazy after midday. Gentle easterly brezzes until late afternoon; light airs to calm thereafter. Smooth sea. Started engine at 18h 57m.

Yokohama, Japan to San Francisco, U.S.A.--Continued

Date	Noon position		Day's run	Current		Remarks
	Latitude	Longitude east		Dir.	Am't.	
1929	° ′	° ′	miles	°	miles	
June 30	38 06 N	147 00	76	98	9	Cloudiness 7 to 4 in morning; 7 to 10 thereafter. Hazy. Light southeasterly airs throughout, except for few hours gentle breeze in afternoon. Smooth to moderate sea. Southeasterly swells. Stopped engine at 12h 50m.
July 1	38 43 N	147 42	49	336	8	Cloudiness 2 to 6, chiefly on horizons. Slight haze in early morning. Light to gentle SE breezes. Moderate sea. Southeasterly swells in morning.
2	39 50 N	149 29	106	35	9	Cloudiness 9 in early morning, decreasing gradually to 3 in early evening, then increasing to 7 in late evening. Gentle to light southeasterly breezes. Moderate to smooth sea. Southeasterly swells in morning.
3	40 22 N	151 03	79	32	15	Cloudiness 7 to 9 during afternoon, otherwise overcast. Gentle southeasterly breezes. Smooth sea.
4	41 22 N	153 16	116	57	11	Overcast throughout. Misty and drizzling in evening. Gentle to moderate southeasterly breeze. Moderate sea.
5	42 35 N	155 33	126	309	9	Overcast throughout, with mist, fog, and drizzling rain. Moderate SExS breeze. Moderate sea.
6	43 45 N	158 12	135	355	7	Overcast throughout, with mist, fog, or drizzling rain. Gentle to moderate SSE breeze. Moderate sea.
7	45 30 N	159 40	122	14	9	Overcast throughout, with fog or drizzling rain. Gentle to moderate southerly breeze. Moderate sea.
8	46 56 N	162 58	161	35	9	Overcast throughout, with mist, fog, or drizzling rain. Moderate to gentle S and W breezes. Moderate sea.
9	47 02 N	166 34	148	153	8	Overcast throughout, with mist or fog. Moderate W breeze until evening, then light northwesterly breeze. Moderate sea.
10	46 43 N	169 27	120	185	8	Overcast throughout, with mist or haze. Moderate to gentle NNE breeze. Moderate sea. Northwesterly swells in evening.
11	46 00 N	171 41	103	235	10	Overcast throughout, with mist or fog. Moderate to gentle NNE to NE breezes. Moderate sea. Northwesterly swells in morning.
12	45 16 N	172 58	69	266	6	Overcast throughout, with thick fog. Gentle to light southeasterly breezes. Smooth sea. W and NW swells in morning, E to SE swells in afternoon.
13	46 22 N	174 08	82	5	9	Overcast throughout, with mist or thick fog. Light to gentle southeasterly breezes in morning, moderate to fresh southerly breeze after midday. Smooth to moderate and choppy sea. Rain during morning. Southeasterly swells in morning.
14	48 07 N	178 06	192	15	9	Overcast throughout, with mist, fog or rain. Fresh southerly breeze. Choppy sea.
14	49 14 N	183 20	218	18	13	Overcast throughout, with mist, thick fog, or rain. Strong to moderate SxW breezes. Choppy, rough sea.
15	50 32 N	187 18	172	63	7	Overcast throughout, with thick fog in morning; hazy thereafter. Fresh to strong SxE breeze. Moderate, choppy sea.
16	51 25 N	192 41	210	14	10	Overcast throughout; heavy mist in evening. Fresh to strong southerly breeze. Choppy sea.
17	52 22 N	198 14	214	26	8	Overcast throughout, with mist, fog, or haze. Strong SxE and S breeze. Choppy sea.
18	52 33 N	204 23	225	47	16	Overcast throughout, with thick fog or mist. Fresh S to SW breezes Choppy sea. Southwesterly swells.
19	51 57 N	209 35	195	116	7	Overcast throughout; drizzling rain in early morning, mist thereafter. Fresh SWxW breeze. Choppy sea. Southwesterly swells.
20	50 13 N	213 54	192	126	5	Overcast throughout; misty until evening, then drizzling rain. Fresh to strong SWxW and SW breeze. Choppy sea. Southwesterly swells.
21	47 59 N	217 17	189	299	13	Cloudiness 9 to 10 (overcast), misty and hazy. Strong SW to W breeze. Choppy sea. Westerly swell in afternoon.
22	45 58 N	220 15	171	311	14	Cloudiness 7 in morning, increasing to 10 (overcast) in evening. Rain in early morning and late evening. Moderate to fresh W to WSW breezes. Moderate sea.
23	44 16 N	222 25	137	295	10	Cloudiness 9 in early morning, decreasing to 4 by noon, remaining so until late evening, then increasing to 9. Drizzling rain at intervals up to 08h 00m, then hazy until noon. Clear after midday. Moderate WxS to WSW breezes. Moderate sea.
24	42 34 N	224 46	144	339	8	Overcast throughout, with rain at intervals throughout. Moderate to fresh SW to S breezes. Moderate sea.
25	40 39 N	227 39	173	283	11	Cloudiness 8 to 10 (overcast) in morning, overcast thereafter. Hazy during day. Drizzling rain and mist in evening. Fresh southerly winds to mid-day, moderate to gentle westerly thereafter. Moderate sea.
26	39 36 N	230 28	144	240	12	Cloudiness 7 just before midday, otherwise 9 to 10 (overcast). Drizzling rain and mist in early morning. Moderate to strong N breeze. Moderate to choppy sea. W swells in early morning.

Yokohama, Japan to San Francisco, U.S.A.--Concluded

Date	Noon position		Day's run	Current		Remarks
	Latitude	Longitude east		Dir.	Am't.	
1929	° ′	° ′	miles	°	miles	
July 27	38 49 N	234 14	182	254	20	Cloudiness 6 to 9 until midday; overcast thereafter. Hazy in late evening. Strong NNW breeze in morning, decreasing in force through afternoon to light in evening. Choppy to moderate sea. Started engine at 21h 30m.
28	37 56 N	237 04	143	207	17	Overcast; haze and fog until noon. Light NNW airs to calm. Moderate to smooth sea. Heard Point Reyes fog signal at 08h 45m.
28	San Francisco		28	....	...	Entered San Francisco harbor at 16h 00m and dropped anchor at 16h 30m.

San Francisco, U.S.A. to Honolulu, T. H.

Total distance, 2186 miles; time of passage, 20.1 days; average day's run, 108.8 miles

1929	° ′	° ′	miles	°	miles	
Sep. 3	San Francisco		....	....	...	Took departure under own power from pier 16, San Francisco harbor at 10h 00m and streamed the log at 13h 45m, through the Golden Gate. Ran 12 miles to Bell No. 5 at 15h 18m, thence 64 miles to the noon position on Sep. 4. Smooth sea, easterly swells in the evening. Overcast and hazy all day. Calm to gentle breeze.
4	37 07 N	236 21	(76)	(330)	5	Smooth to moderate sea. NW swells. Light airs and light S breezes in forenoon and gentle W breezes in the afternoon and evening. Main engine stopped at 08h 00m, started at 13h 50m, and stopped again at 18h 10m.
5	35 30 N	235 02	116	294	23	Moderate sea all day with moderate NW breezes. Cloudiness 10 most of the day with a minimum of 5 at 16h 00m.
6	33 47 N	233 40	123	92	15	Moderate sea; gentle NW breezes. Light drizzle in morning and in late afternoon with the sky overcast much of the day.
7	32 25 N	232 08	112	155	12	Sea moderate in a.m. with NW swells, smooth thereafter. Light and gentle NW breezes. Sky overcast nearly all day.
8	31 36 N	231 13	68	121	8	Smooth sea; gentle NW breezes. Cloudiness 7 to 10. Started main engine at 12h 55m, stopped main engine at 20h 05m.
9	30 23 N	229 06	131	240	10	Sea smooth in morning with gentle NW breezes. Sea moderate with gentle to moderate NNE breezes in the afternoon. Sky partly cloudy.
10	29 19 N	227 27	107	70	11	Sea moderate with gentle to moderate NNE breezes. Sky partly cloudy.
11	28 12 N	225 40	114	198	1	Sea smooth with light to gentle N and NE breezes. Morning sky overcast, partly cloudy in afternoon.
12	27 44 N	224 33	66	234	4	Sea smooth. Light airs to light ExS breezes in morning; calm in afternoon. Sky overcast in morning, clear in afternoon. Main engine started at 11h 20m.
13	26 58 N	222 13	124	47	11	Sea smooth. Light SE airs. Sky clear in morning, partly clear in afternoon. Engine stopped 18h 45m.
14	26 40 N	220 52	75	280	13	Sea smooth. Light S breezes. Sky partly clear, a little rain at 06h 30m. Main engine started 12h 45m. Main engine stopped at 04h 45m, started at 19h 15m, then stopped at 23h 08m.
15	26 27 N	219 24	80	351	12	Sea smooth. Light S airs to gentle S breezes. Sky partly cloudy. Main engine started 04h 40m and stopped 10h 00m.
16	26 13 N	217 56	80	49	15	Smooth sea. Gentle SE breezes. Sky partly clear in morning, and partly overcast in the afternoon. Main engine started at 18h 50m.
17	25 07 N	216 22	108	34	10	Smooth sea in morning with light SE breeze. Moderate sea in the afternoon and evening with moderate NE breezes. Sky clear all day with horizon partly cloudy. Sky overcast in evening, rain at midnight. Stopped engine at 06h 45m.
18	24 02 N	214 26	124	24	15	Moderate sea, moderate NExN breezes. Rain at 01h 20m. Mostly clear near midday with horizon cloudy and partly clear in afternoon. Sky clear, horizon cloudy in evening.
19	23 21 N	211 18	177	76	10	Moderate sea, moderate NExE breezes in forenoon. Sky mostly overcast during afternoon, squally near midnight.
20	22 51 N	208 37	151	98	8	Moderate sea, moderate ExNE breezes in forenoon, moderate ExN breezes in afternoon. Partly cloudy with overhead clear most of the day.
21	22 16 N	206 23	129	54	15	Moderate sea, moderate ENE breezes during first part of morning with gentle breezes ExNE and NExE during the rest of the day. Horizon partly cloudy in the early morning and late evening with sky about half overcast during the day.
22	21 44 N	204 20	119	23	14	Sea moderate. Gentle ESE breezes in morning and gentle ExS breezes in the evening. Few drops of rain in early morning with squalls. Sky partly cloudy during the day.
23	Honolulu		106	....	...	Started engine at 07h 50m. In harbor at 10h 00m.

Honolulu, T. H. to Pago Pago, Samoa

Total distance, 5,777 miles; time of passage, 47.2; average day's run, 122.2 miles

Date	Noon position		Day's run	Current		Remarks
	Latitude	Longitude east		Dir.	Am't.	
1929	° ′	° ′	miles	°	miles	
Oct. 2	Honolulu harbor					Left the dock at 10h 00m assisted by tug. Left tug at 10h 25m and
2	21 16 N	201 54	(14)	....	....	ran 14 miles to bearings at noon. Moderate sea with fresh ENE breeze. Cloudiness 6 to 10 with rain squalls in the evening.
3	23 32 N	200 28	157	174	12	Moderate sea, moderate to fresh ENE breezes in morning, fresh E breezes first part of the afternoon and moderate NExE breezes in the evening. Horizons cloudy, overhead clear during the morning and rain squalls at 16h 00m.
4	26 26 N	199 28	182	198	16	Moderate sea and fresh ENE breezes. Few drops of rain at 15h 24m. Cloudiness 4 to 5, overhead clear during the morning; cloudiness diminished to 3 by evening and to 2 by 24h 00m.
5	29 08 N	198 46	165	220	12	Moderate sea. Moderate to fresh ENE breezes. Cloudiness 3 to 5 during the morning, with the sky about half overcast in the afternoon and a few drops of rain at 13h 30m and at 16h 18m. The sky was partly cloudy in the evening.
6	31 42 N	199 00	154	214	13	Moderate sea during the day; smooth sea in the evening. Moderate to gentle E breezes in a.m. and gentle to light E breezes in p.m. The sky was more than half overcast all day.
7	32 46 N	199 16	64	324	8	Smooth sea with swells. Light E breezes and light E airs in a.m. and light NExE airs and light NE breezes in the afternoon and evening. Sky clear in early morning, cloudiness 3 to 4 during the day and squally near midnight. Started the engine at 11h 18m.
8	34 16 N	200 02	98	230	10	Smooth sea during the day with moderate sea in the evening. Light NE breezes and NE airs and gentle ExS breezes in the forenoon, with light to gentle SE breezes in the afternoon and moderate to fresh SW breezes in the evening. Sky cloudy most of the day with a short drizzle at 18h 42m. Stopped engine at 11h 48m.
9	34 05 N	203 07	153	290	10	Sea moderate and choppy. Fresh to strong SW breezes during the day, with fresh to gentle NW breezes in the evening. The sky was overcast and squally all morning with a short rain squall at 06h 12m. Sky overcast during the afternoon with a little rain at about 17h 00m.
10	33 35 N	205 31	123	233	10	Sea smooth during the early morning, swells during the day, and moderate sea in the late evening. Gentle NW breezes to NW airs during the day with light S airs to gentle S breezes in the first part of the evening and gentle to moderate SxW breezes during the latter part of the evening. Engine started at 09h 00m, stopped at 20h 12m.
11	33 39 N	208 20	141	236	8	Sea moderate in a.m. and choppy in p.m. Moderate to fresh SW breezes all day. The sky was partly cloudy in the forenoon and mostly overcast in the afternoon with a little rain at about 18h 00m
12	33 17 N	212 18	200	258	10	Sea choppy in a.m. and moderate in p.m. Strong to fresh SxW and SW breezes in a.m. with a moderate NW breeze in the first part of the afternoon; calm at 15h 00m. Gentle to moderate SW breezes during the rest of the day. The sky was overcast all day and there were occasional rains.
13	33 26 N	214 36	116	255	7	Moderate sea in a.m. and swells in p.m. Gentle to fresh NW breezes in a.m. with light NW, W, and WSW breezes in the afternoon and evening. The sky was overcast and squally in the morning, and partly cloudy for the rest of the day.
14	33 34 N	216 52	114	237	9	Moderate sea. Gentle and moderate SW breezes in a.m. with fresh SSW and SxW breezes in p.m. The sky was partly cloudy all day with a few drops of rain at 23h 30m.
15	31 48 N	219 15	161	330	18	Choppy sea. Fresh SW breezes in a.m. with breezes NW, NNW, NxE, and NExN, moderate to fresh during the rest of the day. The sky was partly cloudy in the a.m. and completely overcast in the afternoon and evening with rain from 12h 30m to 13h 00m and from 15h 30m to 16h 36m.
16	29 03 N	220 41	181	279	21	Sea moderate to choppy. Fresh NE breezes all day and light SW breezes in the evening. The sky was overcast and cloudy most of the day with a few drops of rain at 03h 30m and rain from 16h 30m to 17h 30m and a drizzle from 20h 30m to 21h 48m. Engine started at 18h 48m, stopped at 19h 42m, and started again at 20h 06m.
17	27 22 N	221 52	119	302	13	Moderate sea in the early morning and smooth sea the rest of the day. Light SSW and SxW breezes in a.m. with light S airs the first part of the afternoon and calms the rest of the day. The sky was mostly clear all day. Engine: stopped at 08h 00m and started again at 10h 42m.
18	26 01 N	222 54	98	313	7	Smooth sea all day. Calm in early morning, variable light airs to light breezes from the SE quarter the rest of the morning and light ExS breezes in the afternoon with gentle ExS and ExN breez-

Honolulu, T. H. to Pago Pago, Samoa--Continued

Date	Noon Position		Day's run	Current		Remarks
	Latitude	Longitude east		Dir.	Am't.	
1929	° ′	° ′	miles	°	miles	
Oct. 19	24 57 N	222 15	373	334	16	Moderate sea. Gentle ESE breezes in a.m. and gentle to moderate ENE breezes in the afternoon. The sky was almost wholly overcast during the early morning hours, with rain squalls and rain from 02h 06m to 02h 18m, from 03h 06m to 03h 12m, and from 06h 18m to 06h 42m. The sky partly cleared near midday but later became overcast. There was a drizzle from 03h 42m to 03h 48m and from 22h 42m to 22h 48m.
20	23 10 N	221 40	112	329	16	Moderate sea. Moderate ExS breezes most of the day. The sky was more than half overcast all day but the cloudiness decreased to 3 in the evening. There were frequent drizzles and rains in the early morning.
21	21 15 N	221 25	116	337	16	Moderate sea and gentle to moderate E breezes in a.m. and moderate breezes from the E, ExN, and ENE in the p.m. The cloudiness was about 8 all day.
22	18 18 N	221 59	180	306	21	Moderate sea in forenoon, choppy thereafter. Breezes: moderate to fresh from the E, ExN, ENE, and NExE. The sky was about half overcast most of the day.
23	16 11 N	222 55	138	306	29	Choppy and moderate sea. Moderate to fresh NExE breezes. The cloudiness was 10 in the early morning and the late evening with an average of 5 during the day.
24	13 34 N	223 19	159	296	24	Seas: choppy, moderate and broken. Breezes: moderate to fresh ExN, ENE, and NE until 13h 00m with light N airs in the afternoon and light SxW breezes in the evening. The sky was almost wholly overcast all day with a drizzle from 00h 12m to 01h 54m, a few drops of rain at 02h 00m and more rain from 18h 18m to 18h 30m. Engine: started at 17h 06m, stopped at 21h 48m, and started again at 23h 12m.
25	12 39 N	222 28	74	188	1	Sea smooth to moderate. In the forenoon there were light breezes variable from the SW quarter and light E airs and calms during the rest of the day. The sky was overcast nearly all day with frequent rains and squalls all day. Engine: stopped at 08h 00m and started at 13h 42m.
26	11 19 N	221 21	104	109	8	Smooth sea. Light NW airs to light NW breezes during the day and calms all evening. Engine: stopped at 08h 00m and started again at 13h 00m.
27	10 05 N	220 17	97	70	16	Smooth sea with light E airs and calms all day. The sky was mostly clear all day but there were rains between 16h 00m and 18h 00m and squalls near 24h 00m. Engine: stopped at 08h 00m and started again at 12h 00m.
28	8 36 N	219 16	107	95	34	Smooth sea. Variable light airs and light breezes from the SE quarter in the a.m. with variable light to gentle breezes from the NE quarter the rest of the day. The sky was about half overcast all day. Engine stopped at 08h 12m.
29	7 44 N	218 38	64	92	30	Smooth sea the first part of the day and moderate thereafter. Variable light to gentle E breezes all day. The sky was about 0.5 overcast all day with a little rain at 02h 42m and at 06h 54m.
30	7 03 N	217 29	80	75	32	Sea smooth to moderate. Variable light to gentle breezes from the SE quarter all morning increasing to moderate and fresh breezes from the same quarter and changeable light breezes from nearly all quarters during the evening. The sky was partly cloudy in the morning and mostly overcast in the afternoon with rains in the evening and a heavy rain from 22h 00m to 23h 00m.
31	6 43 N	216 39	54	72	19	Smooth sea with light SW and SE airs and calms during the forenoon and variable light airs to gentle breezes from the SE quarter in the afternoon. The sky was more than half overcast all day with rain from 00h 00m to 01h 12m and rain from 12h 24m to 12h 48m. Engine: started at 01h 12m, stopped at 02h 12m, and started at 03h 12m, and stopped again at 19h 30m.
Nov. 1	5 46 N	215 20	97	28	15	Sea smooth in a.m. and moderate in p.m. Breezes light to moderate from SE, SExE, and SxE in the morning and the first part of the afternoon and moderate SSE and SExE breezes all evening. The sky was mostly overcast nearly all day; there was a drizzle from 04h 48m to 04h 54m and rain from 09h 12m to 09h 30m and from 12h 48m to 14h 30m. The sky was partly clear in the evening.
2	4 52 N	213 13	137	53	12	Moderate sea with moderate SExS breezes. The sky was completly overcast most of the day.
3	4 18 N	210 44	152	16	32	Moderate sea all day and smooth sea all evening. Moderate SSE and SxE breezes all morning, calm all afternoon and most of the evening with light SExS airs near midnight. The sky was nearly all overcast all day but was partly clear in t. e evening. Engine started at 16h 00m.

Honolulu, T. H. to Pago Pago, Samoa--Concluded

Date	Noon position		Day's run	Current		Remarks
	Latitude	Longitude east		Dir.	Am't.	
1929	° ′	° ′	miles	°	miles	
Nov. 4	3 02 N	210 12	82	13	13	Smooth sea in morning and moderate sea all evening. Light to gentle SExS breezes in a.m., and gentle to moderate SE breezes all afternoon and evening. The sky was partly overcast all day. Engine stopped at 08h 00m.
5	0 48 N	208 32	168	349	12	Moderate sea with moderate and fresh SExE and ESE breezes all day. The sky was mostly clear all day. Crossed the equator at about 18h 30m.
6	1 49 N	207 36	167	356	21	Moderate sea in early morning and choppy the rest of the day. Fresh ExS breezes in a.m. and fresh ExN and ENE breezes the rest of the day. The sky was partly overcast all day.
7	4 52 N	206 36	193	315	19	Moderate sea with moderate NE breezes. The sky was mostly clear in the morning and evening; but was partly cloudy near midday.
8	6 38 N	204 55	145	31	5	Moderate sea and moderate NE, NExE, E, and ENE breezes in the afternoon. The sky was mostly clear all day.
9	8 05 N	203 05	140	20	16	Moderate and gentle ENE, NNE, and NE breezes. The sky was partly cloudy all day.
10	9 00 N	201 56	87	116	8	Moderate sea in forenoon and smooth sea in the afternoon with gentle NE breezes most of the day. The sky was partly clear. Sighted Penrhyn Island at 05h 12m. At Penrhyn Island from 09h 48m to 18h 00m. Engine for short intervals 07h 30m to 18h 00m. Engine: started at 18h 12m and stopped at 19h 54m.
11	9 24 N	200 58	62	58	15	Smooth sea with gentle NE, N, ENE, and ExN breezes. The sky was partly clear most of the day.
12	10 24 N	198 56	135	22	15	Moderate sea in the morning and in the evening with smooth sea near midday, with moderate to gentle ExN, NE, and NNE breezes. The sky was mostly clear all day. Arrived at Tauhunu village Manahiki Island at 12h 24m and left the island at 17h 42m. Engine at intervals 12h 00m to 18h 00m.
13	10 58 N	198 02	63	126	13	Moderate sea most all day with smooth sea in early morning and late evening. Light to gentle NExE breezes in the forenoon and moderate to light NNE breezes in the afternoon. The sky was about 0.5 overcast except near 08h 00m when it was completely overcast, with rain from 06h 12m to 07h 42m and from 09h 00m to 09h 12m.
14	11 35 N	196 36	92	95	13	Smooth sea with light NNE airs in the forenoon and calms in the afternoon. The sky was mostly clear. Started the engine at 08h 42m.
15	12 03 N	195 03	95	65	17	Smooth sea. Light S airs and light E breezes in the forenoon and light NE, SE, and S airs in the afternoon. The sky was mostly clear all day. Engine: stopped at 08h 00m and started again at 13h 48m.
16	12 50 N	193 01	128	30	10	Smooth sea with light SSE breezes and light S airs in the forenoon and calms most of the afternoon. The sky was almost wholly clear all day.
17	13 37 N	191 37	95	109	14	Smooth sea with calms and light SW, W, and WxN airs. The sky was mostly clear all day. Engine: stopped at 08h 00m and started again at 11h 48m.
18	14 13 N	189 34	124 (17)	56	13	Smooth sea with calms and light WNW airs to gentle WNW and NW breezes. The sky was mostly clear. Ran 17 miles from noon position to moorings in Pago Pago harbor at 15h 00m.

Note: Left Pago Pago for Apia about 15h 00m, Nov. 27, arriving at Apia about 08h 00m, Nov. 28. Under engine power all the way with head winds on first leaving Pago Pago, 80 miles.

APPENDIX II. GREENWICH MEAN NOON OBSERVATIONS

Explanation of abbreviations, symbols, and numbers for meteorological results in table 76. Results were reported on Weather Bureau Forms according to "Instructions to marine observers--United States Weather Bureau. The data include: (1) wind direction -- "true;" (2) force according to Beaufort Scale; (3) temperature in screen from Assman Aspirated Psychrometer; (4) sea-surface bucket observations; (5) state of sky--Beaufort Scale.

METEOROLOGICAL SYMBOLS

Letters describe conditions at actual time of observation (Beaufort Scale)

Upper Atmosphere
- b blue sky
- c cloudy sky (detached clouds)
- o overcast sky

Electric Phenomena
- l lightning
- t thunder

Lower Atmosphere
- v visibility (exceptionally clear)
- z haze
- m mist
- f fog

Wind
- q squally

Precipitation
- d drizzling
- p passing showers
- r rain
- r̲ heavy rain
- r̲̲ very heavy rain
- h hail

SYMBOLS

- ⊕ solar halo
- ≡ fog
- ⩛ gale
- ≺ distant lightnings without audible thunder
- ⚡ thunderstorm
- ≡° mist
- ● continuous rain (intensity may be indicated by attaching "exponents" 0 or 2 to the symbols)

CLOUDS

0	stratus	st
1	cirrus	ci
2	cirrostratus	cist
3	cirrocumulus	cicu
4	altocumulus	acu
5	altostratus	ast
6	stratocumulus	stcu
7	nimbus	nb
8	cumulus	cu
9	cumulonimbus	cunb
10	nimbostratus	nbst

SEA

0	calm	0*
1	very smooth	1
2	smooth sea	1- 2
3	slight sea	2- 3
4	moderate sea	3- 5
5	rather rough sea	5- 8
6	rough sea	2-12
7	high sea	12-20
8	very high sea	20-40
9	precipitous sea	40

*Height of wave, crest to trough, in feet

WIND FORCE (Beaufort Scale)

0	calm
1	light airs
2	light breeze
3	gentle breeze
4	moderate breeze
5	fresh breeze
6	strong breeze
7	high wind (moderate gale)
8	gale (fresh gale)
9	strong gale
10	whole gale
11	storm
12	hurricane

SWELL

1	no swell
2	slight swell
3	moderate swell
4	rather rough
5	rough
6	heavy
7	very heavy
8	abnormal

Table 76. Greenwich mean noon observations

Date	Local mean time	Latitude	Longitude east	Wind		Pressure corrected	Temperature			State of sky	Clouds			Sea		Swell	
				Dir.	Force		Dry-bulb	Wet-bulb	Sea-surface		Form	Moving from	Am't.	Dir.	State	Dir.	State
1928	h m	° ′	° ′			mm	°C	°C	°C								
May 14	08 04	37 01 N	299 39	NWxW	4	763.7	14.4	11.4	19.0	op	acu-ast	NWxN	10	NNW	4	.....	..
15	08 12	36 53 N	303 10	N	6	763.7	15.4	13.2	19.2	oq	stcu	NNW	10	NWxN	5	.....	..
16	08 28	37 44 N	306 29	NNW	5	761.0	15.4	11.7	20.2	bcp	acu	NWxN	4	NW	4	.....	..
17	08 30	38 10 N	309 57	WNW	4	760.3	15.0	11.6	19.2	bcp	acu	WNW	7	WxS	4	.....	..
18	08 45	39 05 N	314 18	SE	6	756.9	19.5	15.3	20.4	bcq	cist-acu	SSE	9	S	5	.....	..
19	09 00	40 27 N	317 47	SxE	5	757.7	16.4	15.1	16.2	cmq	cunb	SSE	9	S	5	.....	..
20	09 17	41 44 N	320 54	SE	4	757.1	17.8	16.4	15.4	oz	cist	?	10	ESE	4	.....	..
21	09 30	43 58 N	323 46	SE	3	761.6	15.2	14.2	15.2	od	ast-nb	?	10	SE	3	.....	..
22	09 38	45 16 N	326 24	SE	4	766.4	16.0	15.4	14.7	bcv	cicu	?	3	SE	3	.....	..
23[a]	09 47	44 41 N	326 54	E	3	758.4	15.1	14.2	14.7	oz	ast	SSE	10	ENE	3	.....	..
24[b]	09 50	43 55 N	328 16	NE	8	751.5	14.1	13.4	16.0	odm	st	NNE	10	N	6	.....	..
25	09 54	43 16 N	328 28	NNE	5	756.2	14.3	11.2	15.0	bc	cu	?	8	NExN	4	.....	..
26	09 54	43 56 N	331 24	NxE	3	758.8	14.1	11.1	14.4	bcv	ast	NNE	2	NWxW	3	.....	..
27[c]	10 10	45 41 N	334 19	WxN	5	755.1	14.7	12.1	13.8	bcv	ast	?	7	WNW	3	.....	..
28[d]	10 20	48 04 N	338 33	SSE	7	750.4	15.2	13.3	13.1	oz	st	ENE	10	S	5	.....	..
29	10 37	48 50 N	340 60	SxE	4	750.4	14.8	13.4	13.1	bcv	ci	?	3	SSE	4	.....	..
30[e]	10 47	49 33 N	344 07	SSE	4	760.1	13.5	13.4	12.5	orf	nb	?	10	SExS	3	.....	..
31	11 04	50 22 N	346 29	NNE	1	760.3	13.1	12.8	12.3	opm	st	?	10	.....	2	.....	..
June 1	11 08	50 08 N	346 53	ExN	4	758.9	13.2	12.7	12.7	ofp	nbst	SExE	10	ENE	3	.....	..
2	11 15	49 32 N	347 53	ExN	4	761.6	13.9	12.7	13.1	oz	st	ENE	10	ENE	4	.....	..
3	11 13	50 11 N	347 30	ExN	5	761.7	14.0	12.6	12.5	oz	st	?	8	ENE	5	.....	..
4[e]	11 14	50 18 N	347 49	NE	4	755.8	12.5	11.6	12.7	omd	nb	?	10	ExN	4	.....	..
5	11 18	49 57 N	348 50	ENE	4	752.2	14.1	13.0	12.4	oz	st	?	9	ExN	3	.....	..
6	11 23	50 08 N	349 52	ESE	4	749.6	14.0	13.0	12.9	om	ast-nbst	S	9	SExE	4	.....	..
7	11 29	50 13 N	352 02	SxW	2	747.9	15.1	13.8	13.3	bcv	ast-cicu	SWxS	7	S	2	.....	..
8	11 43	49 58 N	354 55	SxW	3	751.2	15.0	13.6	13.2	bcv	acu-ci	SWxS	6	S	2	.....	..
19[f]	12 00	50 29 N	358 31	SxW	3	755.6	13.1	12.3	13.4	om	st	?	10	SxW	2	.....	..
20	12 00	51 39 N	357 36	NxW	4	759.5	13.5	12.2	13.2	bc	ast	NW	8	NxW	2	.....	..
21	12 00	53 23 N	355 36	NExN	2	766.6	15.2	13.1	13.0	bc	ast	?	7	NE	2	.....	..
July 8	12 39	54 11 N	352 26	WxS	3	767.2	15.4	13.7	13.8	bc	acu	NW	7	NNW	2	.....	3
9	12 15	55 21 N	354 49	W	2	761.8	13.4	12.7	12.8	b	.....	.....	0	SWxW	3	.....	3
10	12 05	58 00 N	357 36	WSW	6	761.0	12.4	11.4	11.7	od	st-nb	SW	10	SW	4	.....	..
11	11 58	60 29 N	359 36	SWxW	4	756.1	11.8	11.1	10.4	bc	acu-ast	SW	7	SW	3	.....	3
12	11 37	62 14 N	355 09	SSW	6	754.2	10.1	9.7	9.5	bc	acu-st	SW	6	SSW	5	.....	..
13	11 16	63 15 N	350 50	SSW	5	748.7	9.8	8.2	9.8	bc	cist-acu	SSW	6	SWxS	7	.....	4
14	11 09	64 05 N	348 24	NNE	1	750.8	8.9	8.1	9.6	bc	ast-ci	?	8	SSW	4	.....	5
15	10 55	63 30 N	345 16	.....	0	759.8	11.2	9.8	10.9	bc	ast-acu	?	5	.....	0	.....	2
16	10 50	63 29 N	342 46	WSW	4	758.0	11.1	9.7	11.3	bc	ci-acu	SW	4	WSW	4	.....	2
17	10 45	62 54 N	341 50	NNW	3	754.3	10.2	9.9	11.6	bc	st-ast	N	4	NW	1	.....	3
18	10 39	62 38 N	340 09	WxN	4	762.1	11.5	10.3	11.2	o	st	NWxN	10	WxN	5	.....	2
19	10 33	63 31 N	338 08	W	3	759.0	11.4	10.8	12.1	bc	st-cu	WxN	8	W	3	.....	3
28	10 33	62 41 N	334 03	NxW	4	764.2	11.2	10.1	11.2	bc	st	N	1	NxW	4	.....	2
29	10 08	60 50 N	329 14	NWxN	4	765.3	10.4	9.6	11.3	o	st	NW	8	NNW	3	.....	2
30	09 57	59 19 N	325 45	WxS	2	767.2	10.0	8.6	11.1	c	ast-cu	W	9	WSW	3	.....	2
31	09 49	58 01 N	325 46	W	3	766.0	10.6	9.0	11.2	o	ast-st	W	10	WxS	2	.....	3

[a] ⩲ [b] ● 2 12h 16h. [c] ⊕ Most distinct at 10h 50m. [d] ⩲ ● at 20h. [e] ≡ [f] ≡ 01h 07h.

Table 76. Greenwich mean noon observations--Continued

Date	Local mean time	Latitude	Longitude east	Wind		Pressure corrected	Temperature			State of sky	Clouds			Sea		Swell	
				Dir.	Force		Dry-bulb	Wet-bulb	Sea-surface		Form	Moving from	Am't.	Dir.	State	Dir.	State
1928	h m	° ′	° ′			mm	°C	°C	°C								
Aug. 1[a]	09 38	58 12 N	324 09	SW	1	756.6	10.2	9.9	10.6	ofd	st-nb	SWxW	10	SSW	2	.....	5
2	09 29	58 18 N	321 46	NE	2	757.2	11.2	9.4	10.8	o	st	NE	10	NExE	2	.....	3
3	09 20	57 58 N	315 21	NNE	6	759.3	9.9	8.4	9.0	bc	ast	NNE	6	NNE	6	.....	4
4	08 51	54 59 N	311 18	NExN	5	765.3	9.7	8.4	9.6	c	ast-st	NNE	8	NE	7	.....	6
5	08 36	51 42 N	310 28	NWxN	4	763.4	9.4	8.0	8.5	bc	ast	NW	3	NE	4	.....	4
6	08 34	48 58 N	311 39	WxS	5	764.6	10.1	8.4	11.2	c	ast-cu	WxS	7	W	4	.....	3
7	08 19	46 07 N	311 58	SWxW	3	767.4	12.5	11.5	11.3	b	ci	SW?	1	SW	1	.....	2
8	08 41	43 27 N	313 08	W	3	767.0	15.1	13.2	15.1	bc	cist	?	5	W	2	.....	2
9	08 45	42 10 N	312 43	NxE	2	767.2	18.6	15.1	21.2	b	cu	N	2	NxE	2	.....	2
10	08 44	40 08 N	311 21	ExS	7	761.2	22.2	21.2	24.1	op	st-nb	ESE	10	ESE	6	.....	3
11	08 33	38 40 N	311 10	W	2	762.3	25.1	23.2	24.6	b	acu-ci	?	2	WSW	2	.....	3
12	08 32	37 09 N	311 29	WxN	1	764.5	26.0	23.3	25.6	bc	ast-acu	?	4	WxN	1	.....	2
13	08 48	36 46 N	313 25	S	3	762.4	25.8	24.0	25.9	bc	ci-acu	SSW	4	S	2	.....	2
14	08 50	35 24 N	315 16	SSW	5	761.5	26.2	24.6	25.6	c	ast-cu	SSW	6	SWxS	4	.....	4
15	09 00	33 42 N	317 38	SW	5	761.9	26.4	24.7	26.3	c	ast-acu	SW	8	SWxS	5	.....	5
16	09 01	31 29 N	318 44	WSW	4	765.1	26.8	25.1	26.9	bc	acu-cu	SW	4	WSW	3	.....	3
17	09 06	29 48 N	319 24	NNE	3	765.6	26.9	24.1	26.9	bc	cu	NExN	3	NNE	2	.....	2
18	09 13	28 11 N	320 16	ENE	4	765.1	26.7	23.2	26.6	bcq	ast-cu	E	4	NExE	3	.....	2
19	09 24	25 46 N	321 08	SExS	3	763.7	25.8	23.6	26.4	bcq	acu-cunb	SE	5	SSE	3	E	2
20	09 22	23 60 N	320 25	E	3	763.9	26.3	22.8	26.7	bcq	stcu-cunb	E	4	ExS	2	ESE	3
21	09 18	22 03 N	320 18	ExN	4	764.2	27.0	23.7	26.5	bc	cu	ExN	3	E	4	ESE	4
22	09 18	19 13 N	321 33	ENE	4	762.2	26.0	23.7	26.0	c	stcu-cu	ExN	9	ENE	4	ExS	4
23	09 24	16 48 N	322 08	ExN	3	760.6	27.0	24.4	26.3	bc	stcu-cu	ExN	4	E	2	ENE	4
24	09 23	15 51 N	322 05	?	0	760.2	28.0	24.5	26.0	b	cu	?	2	0	0	ENE	2
25	09 25	15 00 N	321 52	E?	1	760.4	27.7	24.9	27.0	bc	ci-cu	?	4	0	0	ExN	2
26	09 25	13 55 N	321 53	ESE?	1	761.1	28.4	25.2	27.2	bcp	stcu-cu	?	5	0	0	ExN	2
27	09 25	13 25 N	321 60	ESE	1	762.1	26.3	24.0	26.9	bc	stcu-cu	?	5	0	0	NE	2
28	09 25	12 01 N	322 07	SWxW	2	760.4	27.3	24.8	27.5	c	cist-cu	SW	6	WSW	1	NW	2
29	09 26	10 50 N	322 36	NNE	1	761.1	27.1	24.6	27.3	c	ast-acu-cu	?	9	NNE	1	SSW	2
30	09 26	09 39 N	322 50	SSW	2	761.6	27.6	24.2	27.5	bcp	ast-cu	SW	4	WSW	1	S	2
31	09 27	08 15 N	323 50	WxS	3	762.3	27.0	24.6	27.4	c	stcu-cu	WSW	6	WxS	2	SW	2
Sep. 1	09 36	09 15 N	323 22	SWxW	3	760.9	26.6	23.8	27.2	c	stcu-cist-cunb	WSW	8	SW	3	SSW	4
2	09 35	09 44 N	323 24	WSW	2	760.2	27.4	24.2	27.5	c	cist-stcu-cu	SW	7	WSW	1	SSW	3
3	09 33	11 02 N	322 54	NWxN	2	760.1	27.2	24.5	27.6	c	cist-acu-cu	NW	7	NW	2	SWxW	2
4	09 32	11 21 N	322 13	NNE	4	759.1	28.4	25.2	27.5	bc	cist-acu-cu	NE	6	NNE	4	NExN	4
5	09 29	11 33 N	319 18	NNE	4	759.9	28.2	25.0	27.5	bc	cu	NNE	3	NNE	4	NNE	4
6	09 18	11 41 N	317 34	N	3	760.4	28.4	24.4	27.9	bc	acu-cu	NxE	6	NxE	3	NNE	4
7	09 12	11 20 N	315 49	NNE	2	759.5	28.4	25.0	27.7	b	cist-cu	NNE	2	NNE	1	NE	2
8	09 05	11 34 N	314 55	.....	0	759.6	29.6	25.0	28.2	b	cist-cu	.....	3	.....	0	ENE	4
9	09 01	11 42 N	314 05	NxE	3	760.9	29.1	24.9	27.9	b	cist-acu	?	2	NxE	2	NExN	3
10	08 59	11 54 N	312 38	SWxS	5	759.7	26.8	25.2	27.7	o	cist-acu-cunb	SW	10	SWxS	5	WSW	3
11	08 53	13 09 N	310 25	SxW	3	760.6	28.4	25.0	27.7	bc	cist-ci-acu	?	5	S	4	SExS	3
12	08 45	13 10 N	309 35	NE	2	760.8	28.0	24.7	27.7	bc	cist-cu	NE	6	NE	2	ENE	5
13[b]	08 40	13 15 N	307 47	NExE	3	759.3	28.1	24.2	27.5	bc	cunb-cist-cu	ENE	8	ENE	3	ENE	4
14	08 35	13 06 N	306 03	ExS	3	759.6	27.9	23.1	27.7	b	cist-cu	.....	2	ExS	3	E	3
15	08 30	12 54 N	303 48	ExS	3	760.0	28.0	24.6	27.9	bc	cist-acu-cu	ExS	3	ExS	3	E	3
16	08 20	13 01 N	301 51	E	3	760.7	28.6	25.2	28.1	bc	ci-cu	ExS	6	E	3	E	2

[a] ≡

[b] Hurricane centered over Mona Passage.

Table 76. Greenwich mean noon observations--Continued

Date	Local mean time	Latitude	Longitude east	Wind		Pressure corrected	Temperature			State of sky	Clouds			Sea		Swell	
				Dir.	Force		Dry-bulb	Wet-bulb	Sea-surface		Form	Moving from	Am't.	Dir.	State	Dir.	State
1928	h m	° ′	° ′			mm	°C	°C	°C								
Oct. 2	08 02	14 29 N	298 53	NE	2	761.6	30.2	24.9	28.4	b	ci-cu	NE	4	NExE	1	.....	1
3[a]	07 55	14 46 N	296 37	NNE	3	760.2	28.6	25.4	28.4	bc	ast-cu-cunb	NNE	4	NE	3	.....	1
4	07 47	14 59 N	294 15	ESE	4	760.0	27.5	24.5	28.4	cq	cist-cu-cunb	E	9	ExS	3	E	3
5	07 46	15 16 N	291 54	ExN	3	760.0	28.8	24.8	28.0	c	ci-cist-cu	E	7	E	3	E	3
6	07 37	15 13 N	289 20	ExS	4	759.5	29.8	26.0	28.4	bc	cist-cu	E	8	E	4	E	3
7	07 27	14 48 N	286 28	ExS	4	759.3	28.8	26.2	28.4	bc	cu	E	5	E	4	E	3
8[b]	07 14	13 39 N	283 46	ExS	5	758.4	28.6	25.8	28.5	bc	cist-cu	E	5	E	4	E	4
9[c]	07 05	11 48 N	281 46	ExS	4	757.6	28.4	26.2	28.3	oz	ast-acu-cu	E	10	E	4	E	3
10	07 02	10 28 N	280 53	SE	3	756.7	27.5	25.6	28.5	op	ast-stcu	ESE	9	E	2	E	3
26	07 02	06 37 N	280 05	NW	2	757.6	26.9	25.8	27.5	or	st-nb	?	10	N	3	NxW	2
27[d]	06 42	06 02 N	280 11	.....	0	757.4	23.9	23.5	26.9	or	st-nb	?	10	.....	0	?	2
28[d]	06 42	04 23 N	280 17	SWxW	5	757.3	25.6	25.0	26.7	or	st-nb	SW	10	SW	3	SW	3
29	06 43	04 23 N	280 15	WSW	2	756.7	25.8	22.8	26.6	bc	ast-acu	?	7	WSW	1	SW	3
30	06 54	02 58 N	279 55	SW	4	757.4	24.6	23.7	26.5	or	st-nb	SW	10	WSW	3	SW	3
31	06 54	04 06 N	278 34	SW	5	758.2	25.5	24.2	26.5	op	ast-cunb	SW	10	SW	4	SW	3
Nov. 1	06 47	05 53 N	277 06	SWxW	4	758.1	25.6	24.0	27.0	op	st-cunb-ast	SW	9	SW	5	SW	4
2	06 44	05 07 N	277 18	SW	5	758.1	26.0	24.5	26.8	op	acu-cunb	SW	9	SW	5	SW	5
3	06 47	03 51 N	278 15	SWxS	4	758.6	25.4	23.5	26.5	op	ast-cunb	SW	10	SW	5	SW	4
4	06 49	02 19 N	279 23	SSW	5	760.3	24.8	22.4	26.1	oq	st-nbst	SW	10	SSW	5	WSW	4
5	06 52	01 48 N	279 18	SSW	3	760.7	24.1	22.0	25.9	bc	acu-ast-cu	SW	6	SSW	3	SW	2
6	06 53	00 56 N	278 46	SW	2	761.8	22.4	20.9	24.9	bc	acu-cist-cu	SWxW	5	SWxW	3	SWxW	3
7	06 52	00 18 S	278 19	SW	3	761.0	22.4	20.4	23.7	bc	ast-cu	SWxS	7	SWxW	2	SWxW	2
8	06 50	01 33 S	277 52	SWxW	3	761.6	19.8	18.5	22.4	bc	stcu-cu	SWxS	8	SWxW	3	SWxS	2
9	06 46	01 21 S	275 39	SSW	3	761.5	18.9	17.7	19.4	o	stcu-ast	SxW	9	SSW	2	SxW	2
10	06 39	01 33 S	273 15	SxW	3	716.3	19.6	18.0	20.2	bc	acu-cu	SxW	6	SSW	3	SxW	2
11	06 28	01 50 S	271 26	SxW	2	762.0	20.2	17.2	20.9	bc	acu-cu	SxW	4	SxW	1	S	3
12	06 20	01 32 S	269 05	SxW	2	762.1	19.4	16.8	18.9	bc	acu-ast-cu	?	8	SxW	1	SxE	3
13	06 12	01 32 S	267 04	SExS	2	761.0	19.2	17.9	18.8	o	stcu-cu	SExS	10	SSE	1	SxE	2
14	06 03	01 38 S	266 02	S	1	761.0	19.0	17.6	18.7	op	cunb-cu	SxE	10	S	1	S	2
15	06 00	02 22 S	264 27	SExS	3	761.1	19.6	18.3	19.4	o	st-cu	SxE	9	SExS	2	SE	2
16	05 56	02 57 S	262 19	SSE	4	760.7	19.5	18.9	20.5	oz	ast	?	10	SExS	2	SE	2
17	05 42	03 13 S	260 27	SxE	3	759.4	20.9	19.3	20.6	bc	acu-cu	SExS	1	SxE	3	SE	3
18	05 35	03 47 S	258 05	SSE	3	759.5	21.2	20.0	21.2	bcp	acu-cunb-cu	SExS	6	SExS	3	SE	3
19	05 25	04 32 S	255 20	SExE	3	758.8	22.6	17.2	22.4	bc	stcu-cu	SExS	8	SExS	3	SE	3
20	05 12	06 18 S	253 36	SExE	4	758.9	22.2	19.4	22.3	bc	acu-cu	SExS	3	SExE	4	SE	3
21	05 04	08 45 S	251 55	SExE	4	759.9	22.9	20.2	23.3	bc	ci-cu	SExE	3	SExE	4	SE	3
22	04 59	11 06 S	250 21	SExE	5	761.2	23.0	20.4	23.6	bc	acu-cu	SExE	7	SExE	4	SE	3
23	04 49	13 47 S	248 26	SExE	4	761.9	23.1	20.0	23.7	bcp	acu-stcu-cunb	SExE	5	SExE	4	SE	3
24	04 44	15 56 S	247 18	SExE	4	761.6	23.0	20.6	23.9	bc	ast-stcu	SExE	9	SExE	4	SE	4
25	04 38	18 40 S	246 06	ESE	5	761.8	22.2	20.2	23.8	bc	frcu-cunb	ESE	8	ESE	4	SE	4
26	04 36	21 07 S	245 45	E	4	763.6	22.6	19.6	23.5	bc	frcu-cunb	ExS	7	ExS	3	E	4
27	04 31	22 57 S	245 19	ExS	3	763.6	22.8	20.4	23.4	bcq	ast-cunb	ExS	8	ExS	2	S	5
28	04 34	24 12 S	244 53	ESE	5	764.7	21.3	19.6	23.1	oq	ast-frcu	ExS	10	ExS	3	S	4
29	04 33	26 07 S	244 34	E	4	766.5	22.2	19.4	23.3	bcp	stcu-cunb	ExS	8	ExS	3	S	4
30	04 33	27 49 S	244 49	ENE	2	766.4	21.9	19.8	22.9	bc	stcu-frcu	ExN	4	NExE	2	SE	3
Dec. 1	04 31	28 57 S	245 10	NExE	2	765.4	21.9	19.1	22.7	bc	acu-stcu	NExE	8	NExE	1	ExS	2

[a] Sudden rain and wind squall struck at 04h 30m. Wind reached force 7 for a few minutes. [b] ≤ Throughout night. [c] ⚐ ● 2 19h to 24h. [d] ⚐

Table 76. Greenwich mean noon observations--Continued

Date	Local mean time	Latitude	Longitude east	Wind		Pressure corrected	Temperature			State of sky	Clouds			Sea		Swell	
				Dir.	Force		Dry-bulb	Wet-bulb	Sea-surface		Form	Moving from	Am't.	Dir.	State	Dir.	State
1928	h m	° ′	° ′			mm	°C	°C	°C								
Dec. 2	04 31	30 11 S	245 36	NExE	2	766.8	22.2	19.2	22.8	bc	stcu-cu	NExE	6	NExE	1	ExS	2
3	04 32	31 19 S	246 48	NxE	3	767.1	21.8	19.2	22.3	bc	cist-cu	NxE	4	NxE	2	SxE	6
4	04 39	31 36 S	249 04	NW	4	.....	22.0	19.6	22.2	bc	cist-acu	?	6	NWxN	3	S	4
5	04 47	29 31 S	251 10	WxN	5	762.2	21.8	20.7	22.5	bc	stcu-cunb	WxN	6	WxN	5	SW	4
13	04 54	29 52 S	250 50	ENE	2	766.4	22.8	19.7	23.5	bc	acu-cu	NExE	7	NExE	2	NE	4
14	04 59	29 03 S	250 60	ENE	3	764.6	21.6	20.0	23.7	c	ast-stcu-cunb	NExE	8	NExE	3	NE	4
15	04 50	30 39 S	250 36	ExS	7	761.6	18.6	17.3	21.2	oq	st-nb	ExS	10	ExS	6	E	5
16	04 47	31 58 S	249 21	SSE	4	761.2	18.9	16.2	20.2	bc	stcu-cu	SSE	5	SExS	6	SE	6
17	04 41	31 52 S	250 15	.....	0	764.2	18.5	15.2	20.6	bc	ast-frcu	?	3	?	1	S	5
18	04 45	31 44 S	250 50	NExE	1	765.3	19.8	15.6	20.7	bc	stcu-acu	?	7	NExE	1	S	4
19	04 45	32 19 S	252 30	N 1/2 E	1	764.3	20.2	18.2	19.0	bc	cist-frcu-ast	NNE	5	NxE	1	S	3
20	04 55	33 43 S	253 10	ExN	4	765.0	19.0	17.8	19.6	bc	cist-stcu	ENE?	8	ENE	3	S	3
21	04 57	34 49 S	254 09	ENE	4	766.5	19.4	18.9	19.0	bc	cist-ast-cu	ENE	9	ENE	3	SW	2
22[a]	05 00	36 39 S	255 46	ENE	4	768.9	16.8	16.7	16.9	of	st	ENE	10	ENE	3	NE	2
23	05 06	38 07 S	256 35	ENE	4	771.1	16.8	16.5	16.2	oz	ast-stcu	ENE	10	ENE	3	NE	3
24	05 11	39 41 S	258 36	NExN	4	772.6	16.4	15.4	15.8	cz	cist-ast-st	ENE	9	ENE	3	N	2
25	05 16	40 14 S	260 25	NNE	3	772.6	14.7	13.2	14.4	bc	ast-stcu	NNE	6	NNE	2	N	2
26	05 24	40 22 S	262 25	NNE	1	772.7	16.0	14.4	15.1	bv	ast	?	1	NNE	1	N	2
27	05 32	40 11 S	263 20	NW	3	773.4	16.2	15.1	15.6	bc	cist-cu	?	6	NNW	1	N	2
28	05 37	38 41 S	265 31	NWxW	3	771.5	17.4	16.2	17.0	bc	ci-ast	?	2	NW	2	W	2
29	05 45	37 13 S	266 38	SE	4	768.4	18.2	16.0	18.5	op	stcu-cunb	SSE	8	SE	3	SW	2
30	05 45	34 49 S	267 59	SExS	4	768.3	19.0	16.2	19.1	bc	cu-frcu	SSE	6	SSE	3	S	2
31	05 48	32 48 S	269 41	SSE	4	768.0	19.4	16.8	19.9	oz	st-frcu	SSE	10	SSE	3	S	4
1929																	
Jan. 1	05 53	32 13 S	270 47	SSE	1	768.1	20.1	17.5	20.5	bc	ast-stcu-cu	?	6	SSE	1	SSW	2
2	05 57	31 59 S	271 09	SE	1	769.1	20.9	16.6	20.5	bc	cunb-frcu	SSE	3	SSE	1	SSW	2
3	05 57	31 53 S	271 41	?	0	765.9	21.1	16.4	20.5	bc	stcu	?	2	?	0	?	2
4	06 00	31 51 S	272 24	N	1	765.1	19.9	15.7	20.7	bc	ast-stcu	?	4	N	1	?	2
5	06 05	31 16 S	273 14	W	2	765.3	20.0	17.4	20.1	bc	ast-frcu	WSW	1	W	1	WSW	2
6	06 06	29 31 S	274 17	SSE	4	765.1	20.4	18.0	19.6	bc	frcu	SSE	6	SSE	3	SE	3
7	06 10	27 16 S	275 52	SExE	5	764.5	19.4	16.6	19.3	opq	ast-stcu	SExE	10	SExE	4	SExS	3
8	06 15	25 24 S	277 24	SExE	3	764.3	18.9	15.0	19.1	o	stcu	SExE	10	SExE	4	SExS	3
9	06 23	24 34 S	278 32	SExS	4	763.1	19.0	16.2	19.2	o	stcu	SExS	10	SExS	4	SExS	3
10	06 29	21 36 S	279 32	SE	4	763.0	19.0	14.9	19.1	o	stcu	SExS	10	SExS	4	SExS	3
11	06 31	19 43 S	280 24	SE	4	761.3	19.1	15.6	19.1	o	stcu	SExS	10	SExS	4	SExS	3
12	06 35	17 01 S	281 19	SE	4	759.9	20.6	16.7	21.0	o	stcu	SExS	10	SE	3	SExS	3
13	06 37	14 38 S	281 58	SE	4	759.3	21.7	18.0	21.2	o	stcu	SExS	9	SE	3	SExS	3
14	06 40	12 44 S	282 36	SSE	3	758.3	21.0	19.4	19.3	c	ast-st	?	8	SSE	2	SE	3
Feb. 6	06 58	12 00 S	281 26	SxE	3	759.7	23.2	20.3	23.3	bc	ci-stcu	SxE	6	SxE	3	SE	3
7	06 30	10 33 S	280 21	SSE	3	760.3	23.6	21.0	22.9	bc	cicu-acu	SSE	3	SSE	2	SE	2
8	06 25	10 00 S	278 03	SSE	4	759.8	24.8	22.3	25.0	bc	ci-stcu	SSE	5	SSE	3	SE	2
9	06 17	10 14 S	276 04	SSE	3	759.0	24.2	21.1	24.8	bc	stcu-frcu	SSE	9	SSE	2	SSE	2
10	06 09	10 40 S	275 10	SExS	3	758.7	24.4	21.4	25.0	bc	stcu-cu	SSE	8	SExS	2	SSE	2
11	06 05	10 34 S	274 18	SSE	2	759.2	25.1	21.7	25.2	bc	stcu-frcu	SSE	7	SSE	1	S	3
12	06 02	10 57 S	272 51	SxE	3	759.4	24.0	21.0	24.5	bc	acu-frcu	SxE	6	SxE	2	S	3
13	05 55	12 11 S	270 56	SExS	3	759.1	23.4	20.7	23.9	bc	stcu-frcu	SExS	7	SExS	3	SSE	3
14	05 46	14 03 S	268 13	SExS	5	760.3	22.7	20.1	22.8	bc	ast-stcu-cu	SExS	5	SExS	4	SSE	3

[a] ≡ 08h-18h

Table 76. Greenwich mean noon observations--Continued

Date	Local mean time	Latitude	Longitude east	Wind		Pressure corrected	Temperature			State of sky	Clouds			Sea		Swell	
				Dir.	Force		Dry-bulb	Wet-bulb	Sea-surface		Form	Moving from	Am't.	Dir.	State	Dir.	State
1929	h m	° ′	° ′			mm	°C	°C	°C								
Feb. 15	05 37	15 47 S	265 46	SExS	4	761.1	22.8	20.2	22.7	o	stcu-cu	ESE	10	ESE	4	SSE	3
16	05 26	15 22 S	262 58	ESE	4	761.2	23.1	20.2	23.3	bc	stcu-cu	ESE	8	ESE	4	SE	3
17	05 16	14 44 S	260 07	ESE	4	761.2	23.1	20.5	23.5	o	stcu-frcu	ESE	10	ESE	4	SE	3
18	05 03	14 24 S	257 11	ExS	4	760.4	23.5	20.5	23.7	bc	stcu-cunb	SExE	6	ESE	4	ESE	3
19	04 53	13 48 S	254 55	SExE	4	759.9	23.6	20.0	24.1	bc	frcu-cu	SExE	4	SExE	3	ExS	3
20	04 43	13 07 S	252 19	SExE	4	758.6	23.8	20.6	24.3	bc	stcu-frcu-cu	SExE	7	SExE	3	ESE	2
21	04 34	11 39 S	250 35	ExS	3	758.3	24.0	20.5	24.7	bc	stcu-frcu	E	4	ExS	3	ESE	2
22	04 25	12 35 S	248 10	ExS	4	759.3	24.8	21.0	25.0	bc	stcu-frcu	ExS	6	ExS	4	ESE	3
23	04 17	12 33 S	245 49	SExE	4	759.6	25.1	21.9	25.4	bc	frcu-cu	ESE	4	SExE	4	ESE	3
24	04 05	12 36 S	243 02	ExS	3	758.2	25.4	22.0	25.8	bc	stcu-frcu	ExS	6	ExS	3	ESE	3
25	03 56	12 45 S	241 08	ExN	3	758.7	25.9	22.3	26.2	bc	frcu	ExN	4	ExN	3	E	2
26	03 50	13 03 S	239 16	E	3	758.6	26.0	22.4	26.4	bc	ast-stcu-cu	E	6	E	3	E	2
27	03 41	13 06 S	236 53	ExN	4	759.1	26.2	22.8	26.7	bc	stcu-frcu-cu	E	7	ExN	3	E	3
28	03 29	14 33 S	234 21	ExS	4	758.6	26.4	22.8	27.0	bc	cicu-frcu	ESE	4	ExS	3	E	4
Mar. 1	03 22	15 59 S	232 35	ESE	4	759.3	26.8	22.8	27.4	bc	frcu-cu	ESE	4	ESE	3	E	3
2	03 14	16 58 S	230 43	ExS	3	759.6	26.5	22.9	27.4	bc	frcu	ESE	1	ExS	3	E	3
3	03 08	17 06 S	228 56	ExS	3	760.0	26.8	22.8	27.5	bc	frcu	ESE	2	ExS	3	E	2
4	03 01	17 10 S	227 08	ExS	3	760.6	26.7	23.3	27.5	bc	frcu-cu	ESE	3	ExS	3	E	2
5	02 55	17 08 S	225 22	SExE	3	760.4	27.0	23.5	27.5	bc	frcu-cu	ESE	3	SExE	3	E	3
6	02 47	17 09 S	223 39	NExE	2	759.1	27.4	24.4	27.8	bc	frcu-cu	?	2	NE	2	E	2
7	02 44	17 15 S	221 56	.....	0	759.8	27.3	23.6	28.2	bc	frcu-cu	?	2	.....	0	E	2
8	02 32	17 35 S	219 35	SExS	1	758.6	27.4	23.8	28.2	bc	frcu-cu	SE	3	SE	1	ESE	3
9	02 24	17 42 S	218 27	ESE	3	759.8	27.6	24.2	28.1	bcr	cunb-cu	ESE	4	SE	2	SE	4
10	02 20	18 02 S	216 54	ExS	2	760.1	27.9	24.2	28.1	bc	stcu-cu	E	3	ExS	2	SE	3
11	02 12	17 57 S	214 50	ExN	3	760.2	27.9	24.1	28.1	o	ast-stcu-cu	E	9	ExN	2	E	2
12	02 06	18 03 S	212 57	WNW	2	.....	26.8	24.0	28.0	c	ast-stcu-cu	NW	8	WNW	2	SE	2
13	01 57	17 31 S	210 43	NWxN	2	759.7	25.8	23.8	28.2	o	stcu-cu	NW	10	NW	2	E	2
21	01 58	16 50 S	209 36	ExN	4	756.1	26.8	24.6	28.3	bcq	stcu-cu	E	4	E	3	ESE	4
22	01 49	17 10 S	208 45	N	5	757.0	27.8	24.6	28.4	bcq	stcu-cu	N	6	NxE	4	NE	3
23	01 44	17 23 S	207 49	W	1	758.2	27.0	24.2	28.2	bc	frcu-cu	?	2	?	0	NW	2
24	01 41	17 02 S	206 56	ExS	2	.....	27.2	24.4	28.6	b	cu	?	2	E	1	NE	2
25	01 37	16 43 S	204 60	ExS	4	.....	28.2	25.3	28.6	bcl	frcu-cu	ExS	6	ExS	3	E	3
26	01 29	16 18 S	202 45	E	4	757.6	28.2	25.6	28.5	cqr	stcu-cu-cunb	E	7	E	3	E	2
27	01 20	15 50 S	200 12	NxE	4	757.3	25.6	23.9	28.6	oqr	stcu-cunb	NE	10	NNE	3	NE	2
28	01 12	15 36 S	198 39	ExS	2	756.6	25.8	24.6	28.6	olp	cu-cunb	E	9	ExS	2	E	2
29	01 07	15 26 S	197 27	.....	0	756.8	28.1	24.9	28.5	bc	cu	?	3	?	0	ESE	2
30	01 00	14 58 S	195 26	SExE	1	756.4	28.2	25.2	29.0	bc	stcu-cu	?	2	?	0	SE	2
31	00 51	14 42 S	193 01	.....	0	756.9	28.1	25.2	29.0	bcp	acu-cunb	?	5	?	0	SE	2
Apr. 1	00 44	14 38 S	191 01	WNW	1	757.5	28.2	25.2	28.6	bc	stcu-cu	?	4	WNW	1	.....	1
22	00 35	13 19 S	188 19	ExS	3	758.7	28.8	26.0	29.4	bc	stcu-frcu	E	6	E	2	.....	1
23	00 34	12 12 S	188 03	ESE	3	758.4	27.6	25.1	29.3	bcqp	ast-acu	SE?	6	ESE	2	E	2
24	00 35	09 39 S	188 60	ExS	5	757.6	28.9	26.0	29.2	bc	acu-frcu	E	3	E	4	E	2
25	00 37	08 02 S	188 31	NE	1	757.3	28.6	25.4	29.2	bc	acu-cu-frcu	?	4	NE	2	ESE	2
26	00 35	06 45 S	187 45	NNE	2	757.4	26.7	24.0	29.0	bcq	cist-cu	NE?	5	NNE	2	E	2
27	00 33	05 50 S	187 36	.....	0	757.4	28.2	24.3	28.8	bc	acu-cu	?	3	.....	0	NE	2
28	00 32	04 19 S	187 27	NNE	1	757.8	27.8	24.4	28.2	bc	cist-acu	?	4	NNE	1	NE	3
29	00 31	02 46 S	186 47	NExE	3	757.3	27.6	24.7	27.9	bc	ci-frcu	NE	4	NE	2	NE	3
30	00 30	00 39 S	186 14	ExN	4	.....	27.1	25.0	27.2	bcqr	stcu-frcu	E	2	ExN	4	NE	3

Table 76. Greenwich mean noon observations--Continued

Date	Local mean time	Latitude	Longitude east	Wind		Pressure corrected	Temperature			State of sky	Clouds			Sea		Swell	
				Dir.	Force		Dry-bulb	Wet-bulb	Sea-surface		Form	Moving from	Am't.	Dir.	State	Dir.	State
1929	h m	° ′	° ′			mm	°C	°C	°C								
May 1	00 27	01 37 N	185 22	NExE	4	757.3	27.6	25.2	27.3	cqr	stcu-cunb	NE	9	NE	4	NE	3
2	00 23	03 38 N	184 05	NE	5	757.8	27.8	25.4	27.8	bcpq	stcu-cu-cunb	NE	6	NE	4	NE	3
3	00 17	05 13 N	183 06	NExE	5	757.6	27.4	25.4	27.6	opq	stcu-cunb	NE	10	NE	5	NE	3
4	00 13	07 28 N	181 37	NE	3	758.2	27.0	24.8	27.6	cpqz	stcu-cunb	NE	8	NE	3	NE	3
5	00 08	09 21 N	180 16	ENE	5	758.9	27.0	24.6	27.2	cpq	stcu-cu	ENE	6	ENE	4	NE	3
Crossed International Date Line																	
6	00 02	12 22 N	181 43	ENE	6	759.0	26.4	23.1	26.3	bc	frcu-cu	ENE	2	ENE	5	NE	4
7	23 53	14 34 N	183 57	ExN	4	760.0	25.9	23.6	26.0	bc	stcu-cu	E	4	ExN	4	NE	3
8	23 43	15 58 N	186 48	ENE	5	760.2	26.2	23.6	26.1	bc	ast-frcu	ENE	2	ENE	3	ENE	3
9	23 29	17 31 N	189 32	ENE	5	760.1	25.8	23.7	26.0	bc	frcu-ast	ENE	3	ENE	4	ENE	3
10	23 17	18 56 N	192 16	ExN	4	.....	26.0	23.1	26.2	bc	frcu-cu	E	3	ExN	3	NE	2
11	23 07	19 48 N	194 44	ExN	4	761.7	26.0	22.6	26.1	bc	cu-frcu	E	2	E	4	NE	4
12	22 57	20 15 N	197 38	ENE	4	762.4	25.6	23.2	25.9	bc	cu-frcu	NE	3	ENE	4	ENE	2
13	22 46	20 13 N	200 10	E	4	762.1	26.0	23.2	26.5	bc	cu-frcu	E	3	E	3	ENE	3
14	22 37	19 03 N	202 44	ExS	4	761.3	26.6	24.2	26.8	bc	frcu	E	1	ExS	3	ENE	2
15	22 27	18 06 N	205 13	SExS	4	761.4	27.2	24.6	27.0	bc	cu-stcu-frcu	SE	4	SExS	3	E	2
16	22 17	16 52 N	207 41	ExS	4	761.3	27.4	24.8	27.1	bc	cist-acu-cu	E	6	ExS	4	E	4
17	22 07	15 34 N	210 17	ExS	4	761.0	27.6	24.8	27.5	bc	cu-frcu	E	4	ExS	4	E	4
18	21 56	14 25 N	212 51	E	4	761.1	27.9	25.2	27.7	bcp	acu-cu-cunb	E	8	E	4	E	3
19	21 46	13 47 N	214 55	E	4	759.6	28.1	25.2	27.9	bc	cu-frcu	E	5	E	3	E	2
25	21 56	14 21 N	215 35	ENE	4	758.9	28.2	25.4	28.1	bc	ci-cu	ENE?	6	ENE	3	ENE	3
26	21 38	17 15 N	215 55	E	4	759.9	28.3	24.5	28.2	bc	ci-cu	E	3	E	4	ENE	4
27	21 40	19 47 N	215 58	E	4	760.7	28.2	24.2	28.4	bc	cu-frcu	E	2	E	4	E	3
28	21 39	22 17 N	215 46	E	3	761.8	28.4	24.8	28.4	bc	cist-frcu	E	5	E	2	E	2
29	21 38	24 07 N	216 00	ESE	1	761.8	27.2	25.5	26.0	bc	cist-cu	?	3	ESE	1	E	2
30	21 38	25 46 N	215 44	S	2	761.1	26.8	24.8	25.9	bcz	ci-cu	?	2	S	2	ESE	2
31	21 40	27 07 N	215 44	S	1	760.3	24.8	23.9	23.5	bcz	ast-cist	?	2	?	0	SSE	2
June 1	21 38	29 35 N	216 10	SxW	6	754.9	23.0	22.2	20.8	oz	cist-ast-stcu	S	8	SxW	5	SSW	5
2	21 38	30 34 N	215 32	NxW	1	759.0	20.1	18.0	20.2	bcz	cist-ast	?	8	NxW	2	SSW	6
3	21 38	31 41 N	216 23	WxS	4	757.8	20.6	19.4	20.0	cz	ast-stcu	W	8	W	3	SW	5
4	21 30	33 12 N	218 18	WxS	3	757.3	22.6	21.4	21.4	oz	ast-stcu	SW	10	WxS	3	SW	3
5	21 26	34 31 N	219 42	SWxW	4	.....	20.9	19.8	18.8	oz	ast-stcu	SW	10	SWxW	3	SW	2
6	21 26	34 49 N	218 58	WSW	4	750.7	20.2	18.2	18.5	bc	ast-stcu-cicu	.....[a]	5	SWxW	6	?	?
7	21 23	35 26 N	220 19	NExN	3	758.3	16.2	14.4	18.6	oz	ast-stcu	NE	10	NE	2	?	1
24	20 59	34 50 N	219 56	ENE	1	761.6	20.8	19.6	23.0	oqp	ast-st-nb	?	10	NE	2	E	4
25	21 22	35 22 N	218 40	ExS	2	763.6	22.4	20.8	23.5	bc	stcu-st	E?	4	E	2	E	4
26	21 25	36 19 N	217 08	SSE	3	764.5	19.6	18.8	19.0	bc	stcu-ast	?	4	SSE	1	SE	3
27	21 32	36 41 N	215 43	.....	0	763.7	20.7	20.0	20.1	bcz	stcu-st	?	2	SE	1	SE	2
28	21 38	36 56 N	214 38	ESE	2	764.4	18.8	17.3	20.3	bcz	cist-ast	SE?	4	ESE	1	E	2
29	21 38	38 04 N	214 10	.....	0	764.7	18.4	15.7	20.4	bcz	acu-stcu	?	5	.....	0	ESE	2
30	21 44	38 25 N	212 34	SSE	1	766.5	17.2	15.8	15.0	oz	stcu-ast	?	9	SSE	1	SE	3
July 1	21 45	39 17 N	211 40	SE	3	766.4	15.8	13.8	16.4	bcq	stcu-ast	SE?	4	SE	2	SE	3
2	21 51	40 06 N	209 45	SSE	3	764.4	15.6	13.7	15.6	bcz	stcu-ast	SE?	5	SSE	2	SE	2
3	21 58	40 38 N	208 14	SE	4	764.1	13.8	12.3	16.2	oz	acu-stcu	?	9	SE	3	SE	2
4	22 07	41 54 N	205 35	SE	3	763.3	11.4	11.1	10.9	om	ast-nbst	?	10	SE	2	SE	2
5	22 15	43 08 N	203 05	SExS	4	762.9	11.0	10.7	10.1	ofd	st	?	10	SE	3	SE	2

[a] Upper N, lower SW

Table 76. Greenwich mean noon observations--Cont

Date	Local mean time	Latitude	Longitude east	Wind		Pressure corrected	Temperature			State of sky	Clouds			Sea		Swell	
				Dir.	Force		Dry-bulb	Wet-bulb	Sea-surface		Form	Moving from	Am't.	Dir.	State	Dir.	State
1929	h m	° ′	° ′			mm	°C	°C	°C								
July 6	22 26	44 41 N	201 02	SSE	3	761.4	10.1	9.8	8.3	ofd	st	SE?	10	SSE	3	SE	2
7	22 32	46 17 N	198 57	S	4	756.3	9.4	9.2	7.2	fr	st	S?	10	S	3	SSE	2
8	22 46	47 01 N	195 16	WxN	4	753.5	7.2	6.9	7.3	odm	ast	.....[a]	10	W	3	S	2
9	23 00	47 11 N	192 10	NW	2	752.9	7.9	7.8	7.4	of	st	.....[a]	10	NW	3	NW	2
10	23 12	46 22 N	189 26	NNE	4	759.0	8.0	7.6	7.7	m	st	.....[a]	10	NNE	3	.....	1
11	23 19	45 12 N	187 22	NExE	4	765.4	9.0	8.8	8.8	of	st	.....[a]	10	NNE	3	N	2
12	23 25	45 48 N	186 25	SExE	2	767.0	9.5	9.4	8.8	of	st	.....[a]	10	SE	3	NE	2
13	23 30	47 14 N	183 55	S	5	765.2	10.1	10.0	8.3	of	ast-st	.....[a]	10	S	4	SE	2
14	23 46	48 38 N	180 38	SSW	5	763.2	10.1	10.1	8.0	od	st-nb	.....[a]	10	SSW	5	.....	1
15	00 06	49 55 N	185 35	SSW	4	764.7	9.7	9.4	8.2	m	st	.....[a]	10	SSW	5	SW	2
16	00 22	50 55 N	190 13	SxE	5	768.8	10.0	9.4	8.2	oz	ast	.....[a]	10	S	4	S	2
17	00 42	51 59 N	196 01	SxW	6	769.9	9.6	9.4	9.2	oz	ast	.....[a]	10	S	4	.....	1
18	01 05	52 35 N	201 49	SxW	6	769.7	9.7	9.6	9.6	oz	ast-st	.....[a]	10	S	4	.....	1
19	01 29	52 10 N	207 40	WSW	5	766.7	10.9	10.7	10.5	oz	ast	.....[a]	10	SW	4	S	2
20	01 49	51 00 N	212 10	WxS	5	762.0	11.1	11.0	10.7	moz	ast-st	.....[a]	10	WxS	4	SW	2
21	02 09	48 44 N	216 11	WSW	6	759.5	11.3	11.2	11.1	om	st	.....[a]	10	WSW	4	SW	4
22	02 21	46 42 N	219 13	WxN	4	.....	11.4	10.2	11.8	o	stcu-ast	.....[a]	9	W	5	WSW	3
23	02 34	44 41 N	221 52	WxN	4	.....	11.4	10.8	13.2	o	ast-cu	.....[a]	9	W	4	W	2
24	02 41	43 12 N	223 51	WxN	4	766.0	13.4	11.4	14.2	o	ast	.....[a]	10	W	4	W	2
25	02 50	41 05 N	226 55	SE	5	765.7	16.2	13.2	16.1	c	ast-stcu	.....[a]	8	SE	4	W	2
26	03 03	40 02 N	229 20	NxE	4	766.6	16.2	14.9	17.0	omd	ast	.....[a]	10	NxE	3	W	2
27	03 15	39 02 N	233 08	N	6	763.3	15.8	13.9	16.0	c	ast	.....[a]	6	N	4	.....	1
28	03 30	38 19 N	236 14	NNW	2	761.5	12.4	12.0	12.4	of	ast-st	.....[a]	10	NNW	2	.....	1
Sep. 4	04 00	37 10 N	236 35	SxW	2	759.8	16.2	14.7	16.7	o	ast	.....[b]	10	SxW	1	WxN	4
5	03 41	36 20 N	235 47	NWxW	4	760.6	17.2	14.8	17.4	o	ast-acu	.....[b]	10	WNW	3	WxN	2
6	03 35	34 10 N	233 54	NWxN	3	761.0	18.0	16.8	18.6	cp	ast-stcu	.....[b]	7	NWxN	3	.....	1
7	03 32	32 47 N	232 29	NWxW	3	760.7	17.4	16.4	19.6	cqp	ast-stcu	.....[b]	9	NWxW	2	.....	1
8	03 31	31 49 N	231 23	NWxW	3	760.4	19.7	16.4	20.5	c	ast-stcu	.....[b]	9	NWxW	2	WxN	2
9	03 29	30 48 N	229 48	NWxN	3	762.0	20.6	17.2	21.7	bc	ast-frcu	.....[b]	5	NW	2	.....	1
10	03 21	29 35 N	227 54	NExN	4	.....	21.0	17.0	22.2	c	ci-cu	.....[b]	6	NE	3	NW	2
11	03 14	28 35 N	226 18	NNE	3	761.3	21.8	17.6	22.5	c	cu-frcu	.....[b]	9	NNE	2	N?	2
12	03 06	27 48 N	224 48	ESE	2	761.0	22.4	18.2	22.8	bc	acu	.....[b]	8	ESE	2	NE?	2
13	03 02	27 19 N	223 11	.....	0	762.2	22.4	18.2	23.6	bc	cu-frcu	.....[b]	2	.....	0	WNW	3
14	02 52	26 44 N	221 17	SSW	2	.....	23.0	19.3	23.9	cr	cu-cunb	.....[b]	6	SSW	1	?	2
15	02 48	26 38 N	220 02	SW	1	760.7	23.2	20.5	23.9	bc	acu-cu	.....[b]	2	SW	1	.....	1
16	02 42	26 22 N	218 26	SxE	3	763.1	24.0	20.6	24.7	bc	ast-frcu	.....[b]	5	S	2	SW	2
17	02 36	25 37 N	217 04	ESE	2	763.9	24.0	20.4	15.0	b	frcu	SE?	2	ESE	1	.....	1
18	02 30	24 23 N	215 09	NExE	4	.....	24.6	20.5	25.3	c	frcu	NE	9	NE	3	NE	2
19	02 24	23 32 N	212 35	ENE	4	763.1	24.6	20.6	25.5	bc	frcu	ENE	2	ENE	3	NE	2
20	02 11	23 02 N	209 35	ExN	4	761.3	25.3	21.4	26.4	bc	st-acu-frcu	ENE	7	ExN	3	NE	2
21	02 02	22 28 N	207 14	ESE	4	761.2	25.4	22.6	26.4	bc	cist-acu-frcu	ESE	4	ESE	3	NE	2
22	01 53	21 59 N	205 04	NExE	4	761.3	26.0	23.4	26.6	bc	cu-cunb-frcu	ENE	3	NE	3	NE	2
23	01 44	21 28 N	203 06	SExE	4	760.8	26.3	23.2	27.0	b	cu	?	1	ESE	3	NE	2
Oct. 3	01 24	22 44 N	200 58	ExN	5	762.2	25.3	22.3	26.4	bc	ast-cu	.....[b]	5	ENE	4	NE	3
4	01 20	25 06 N	199 54	ExN	4	.....	25.6	21.8	26.2	bc	frcu	.....[b]	3	E	3	NE	3
5	01 16	28 12 N	199 02	ExN	5	763.7	24.6	20.8	25.7	bc	frcu?	.....[b]	2	E	4	NE	3

[a] Not able to determine. [b] Difficult to determine because of dark nights.

Table 76. Greenwich mean noon observations--Concluded

Date	Local mean time	Latitude	Longitude east	Wind		Pressure corrected	Temperature			State of sky	Clouds			Sea		Swell	
				Dir.	Force		Dry-bulb	Wet-bulb	Sea-surface		Form	Moving from	Am't.	Dir.	State	Dir.	State
1929	h m	° ′	° ′			mm	°C	°C	°C								
Oct. 6	01 15	30 49 N	198 38	ExS	4	756.9	24.5	21.8	24.9	bc	cu	.....[a]	3	E	4	ESE	4
7	01 17	32 34 N	199 16	ExS	2	768.9	23.7	21.3	24.2	bc	cu	.....[a]	2	E	2	E	3
8	01 18	33 40 N	199 36	NExE	2	767.9	22.0	19.3	23.4	bc	cu	.....[a]	4	NE	2	NW	3
9	01 26	34 13 N	201 37	SWxS	6	760.9	22.6	21.1	22.9	cq	cu	.....[a]	6	SW	4	SW	4
10	01 39	33 46 N	204 46	NW	3	762.7	20.5	17.1	23.4	bc	cu?	.....[a]	2	NW	2	NW	5
11	01 49	33 36 N	207 16	SSW	4	.....	23.0	21.3	22.8	c	cunb?	.....[a]	8	SSW	3	NW	4
12	02 03	33 26 N	210 42	SSW	6	761.4	22.9	21.5	22.5	cq	cu?	.....[a]	6	SSW	5	W	3
13	02 15	33 24 N	213 48	NWxW	4	.....	19.4	18.3	22.1	oq	stcu?	.....[a]	9	NW	3	W	4
14	02 23	33 30 N	215 41	WSW	3	758.4	20.5	17.3	22.2	bc	cu?	.....[a]	2	WSW	2	NW	4
15	02 35	32 14 N	218 41	SWxS	5	757.6	22.1	20.0	22.4	c	cu	.....[a]	6	SW	4	W	2
16	02 40	30 14 N	220 06	NE	5	763.0	21.3	18.7	22.6	o	stcu	.....[a]	10	NE	4	W	4
17	02 46	27 51 N	221 26	SWxS	2	762.5	22.6	20.2	23.3	bc	ci-cu	.....[a]	5	SW	2	W	3
18	02 52	26 25 N	222 53	.....	0	.....	22.1	19.0	23.3	c	ast-cu	.....[a]	8	.....	0	NW	3
19	02 50	25 08 N	222 26	SExE	3	762.9	21.1	19.3	22.9	cq	cunb	.....[a]	9	SE	1	NW	2
20	02 49	23 58 N	222 09	SExE	4	760.4	22.0	20.8	23.5	oqr	cunb-frcu	.....[a]	10	SE	3	NW	2
21	02 46	21 45 N	221 19	ExS	4	760.3	22.9	19.7	23.5	bcz	cist-cu	.....[a]	5	ESE	3	E	2
22	02 47	19 27 N	221 38	ExS	4	760.3	23.5	20.9	23.8	bcz	cist-frcu	.....[a]	5	E	4	E	3
23	02 51	16 46 N	222 45	ENE	4	759.1	24.6	21.2	25.5	oz	ast-cu	.....[a]	9	ENE	3	E	3
24	02 55	14 27 N	223 41	ExN	4	758.8	24.4	22.6	25.9	ozp	ast-cunb?	.....[a]	10	E	4	E	2
25	02 51	13 01 N	222 45	NWxW	3	.....	23.9	22.8	26.3	old	cunb-cu	.....[a]	9	NW	1	S	2
26	02 47	11 47 N	221 46	WxN	2	758.9	25.2	22.5	26.4	c	ast-cu?	.....[a]	6	W	1	N	2
27	02 42	10 24 N	220 31	.....	0	759.8	25.9	23.2	27.0	b	.....[b]	.....[a]	0	.....	0	.....	1
28	02 38	09 05 N	219 34	SxE	2	760.5	26.0	23.6	27.5	cz	.....[b]	.....[a]	6	S	2	S	2
29	02 35	07 58 N	218 45	ExS	3	758.7	26.0	23.9	28.1	orq	.....[b]	.....[a]	9	E	2	SE	2
30	02 32	07 21 N	217 58	SExE	3	.....	26.3	23.9	28.1	bcz	.....[b]	.....[a]	4	SE	2	SE	2
31	02 27	06 44 N	216 39	.....	0	755.5	24.7	23.4	27.8	orq	.....[b]	.....[a]	10	.....	0	SE	2
Nov. 1	02 24	05 58 N	215 54	SE	3	754.7	26.8	24.0	28.2	bc	.....[b]	.....[a]	4	SE	2	S	2
2	02 16	04 59 N	213 58	SSE	4	754.2	27.8	24.3	27.7	oq	.....[b]	.....[a]	9	SE	4	SE	3
3	02 08	04 32 N	211 59	SxE	4	.....	26.1	23.5	26.6	oz	frcu?	.....[a]	10	S	4	S	2
4	02 02	03 29 N	210 26	SSE	2	756.4	26.3	23.3	27.6	bc	frcu	.....[a]	5	SSE	1	E	2
5	01 46	01 51 N	209 07	SE	5	755.6	26.2	23.6	27.3	bc	frcu	SE?	3	SE	4	E	3
6	01 51	01 05 S	207 49	ESE	5	.....	26.4	24.0	26.8	bc	frcu	SE	4	ESE	4	E	2
7	01 49	03 51 S	207 10	ENE	5	.....	26.9	24.0	27.3	bc	frcu	ENE	4	ENE	4	E	3
8	01 42	06 04 S	205 29	NExE	4	755.9	26.9	23.6	27.8	bc	cu	ENE?	3	NE	3	E	2
9	01 35	07 31 S	203 51	ExN	4	755.2	27.5	24.1	28.2	bc	frcu	E	3	ENE	3	NE	2
10	01 29	08 44 S	202 16	NExE	3	754.3	27.8	24.4	28.4	bc	frcu	ENE	2	NE	3	?	3
11	01 24	09 13 S	201 26	NExE	3	755.2	27.8	24.4	28.4	bc	frcu-cu	NE	4	NE	2	E	2
12	01 20	09 44 S	200 01	E	4	756.0	28.0	24.2	28.2	bc	frcu	E	3	E	3	NE	3
13	01 14	10 40 S	198 30	NExN	2	757.7	28.1	24.7	28.6	bcl	cu-cunb	?	3	NE	2	NE	4
14	01 08	11 26 S	197 05	NExN	2	756.8	27.7	23.8	28.6	bc	acu-frcu	?	2	NE	1	NE	3
15	01 02	11 54 S	195 37	SxW	1	755.8	27.5	24.6	28.8	bc	ci-acu-cu	?	4	S	1	S	4
16	00 56	12 26 S	193 57	SExS	2	755.8	27.5	24.0	28.8	bc	cicu-cu	?	2	ESE	1	S	2
17	00 48	13 24 S	191 57	.....	0	755.5	27.9	24.3	28.6	bc	frcu-cu	?	2	.....	0	?	2
18	00 42	13 55 S	190 35	.....	0	754.7	27.8	25.0	28.3	bc	cu	?	2	.....	0	NW?	2

APPENDIX III

TABLES 77 - 81. HOURLY VALUES OF ATMOSPHERIC PRESSURE, AIR TEMPERATURE, SEA-SURFACE TEMPERATURE, VAPOR PRESSURE, AND RELATIVE HUMIDITY

Crossed 180° meridian on May 5, 1929, eliminating May 6,
and on July 14, 1929, making two dates, July 14

Table 77. Hourly values of atmospheric

Date	Latitude	Longitude east	Values in mm at local										
			00	01	02	03	04	05	06	07	08	09	10
1928	°	°											
May 16	37.8 N	306.9	61.1	60.9	60.5	60.3	60.2	60.2	60.2	60.2	60.1	60.2	60.3
17	38.2 N	310.3	59.5	59.4	59.5	59.1	59.2	59.3	59.4	59.7	60.1	60.3	60.1
18	39.2 N	314.4	59.4	59.4	59.1	58.7	58.5	58.0	58.0	58.0	57.5	57.2	57.3
19	40.6 N	318.2	57.0	57.0	57.1	57.1	57.0	57.1	57.1	57.4	57.5	58.0	58.1
20	42.0 N	321.2	57.1	57.0	56.5	56.7	57.0	57.1	57.2	57.8	58.0	57.8	57.9
21	44.0 N	324.0	59.1	59.1	59.2	59.3	59.5	59.9	60.3	60.7	60.9	61.1	61.2
22	45.5 N	326.7	64.4	64.4	64.4	64.4	64.4	64.3	64.8	65.0	65.4	65.5	65.7
23	45.0 N	326.9	64.0	63.8	63.0	62.5	61.5	61.0	60.9	60.7	60.1	59.7	59.2
24	43.9 N	328.4	52.9	52.5	51.9	51.8	51.3	51.3	51.8	51.4	51.7	51.8	52.0
25	43.2 N	328.6	55.1	55.0	54.9	54.9	55.0	55.1	55.3	55.8	55.8	55.9	56.1
26	44.0 N	331.6	57.6	57.6	57.6	57.6	57.5	57.6	57.9	58.0	58.1	58.4	58.7
27	45.8 N	334.5	56.8	56.4	56.0	55.7	55.6	55.5	55.0	55.0	54.7	54.4	54.2
28	48.2 N	338.9	50.9	51.0	50.8	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0
29	48.8 N	341.2	50.0	50.1	50.2	50.6	51.2	51.8	52.1	52.3	53.1	53.7	54.1
30	49.6 N	344.4	58.7	58.5	58.8	58.9	59.0	59.0	58.9	59.0	59.1	59.2	59.4
31	50.4 N	346.5	61.1	61.0	60.8	60.8	61.0	60.7	60.8	60.8	60.7	60.7	60.6
June 1	50.0 N	346.9	57.4	57.3	57.1	57.1	57.0	57.2	57.4	58.0	58.1	58.1	58.1
2	49.5 N	348.0	60.7	61.0	60.7	60.7	61.0	61.1	61.2	61.4	61.9	62.0	62.0
3	50.2 N	347.4	61.7	61.9	61.3	61.2	61.1	61.1	61.1	61.1	61.1	61.1	61.3
4	50.5 N	347.7	59.9	59.3	59.1	58.9	58.3	58.3	58.1	57.6	57.2	57.0	56.9
5	49.9 N	348.9	53.5	53.3	53.0	52.9	52.9	52.8	52.9	53.0	52.9	52.7	52.3
6	50.2 N	350.0	52.7	52.1	51.9	51.6	51.4	51.7	51.7	51.4	51.0	50.8	50.7
7	50.2 N	352.0	50.2	50.0	49.7	49.2	49.1	49.0	48.8	48.7	48.1	47.9	47.9
8	50.0 N	354.9	46.9	47.1	48.0	48.1	48.6	49.0	49.4	50.0	50.3	50.7	50.8
19	50.5 N	359.0	58.1	57.9	57.4	57.0	56.6	56.2	56.2	56.1	56.1	56.1	56.2
20	51.7 N	2.3	56.3	56.2	56.2	56.3	56.4	56.7	56.9	57.1	57.4	57.4	58.1
21	53.4 N	4.4	63.2	63.7	63.9	64.0	64.1	64.5	64.9	65.1	65.4	65.6	65.7
July 8	54.1 N	7.6	65.4	65.9	66.0	66.1	66.2	66.3	66.5	66.9	67.2	67.3	67.4
10	58.0 N	2.4	60.9	60.6	60.4	60.2	60.2	60.0	60.1	60.1	60.3	60.4	60.4
11	60.5 N	0.3	55.6	55.3	55.1	54.4	54.3	54.3	54.5	54.8	55.2	55.5	55.6
12	62.3 N	355.0	55.4	55.3	55.1	55.2	55.1	55.3	55.8	55.8	55.6	55.4	55.2
13	63.3 N	350.6	50.7	50.7	50.5	50.3	50.0	49.7	49.4	49.3	49.3	49.2	49.2
14	64.1 N	348.6	49.3	49.3	49.4	49.5	49.6	50.1	50.3	50.4	50.9	51.1	51.1
15	63.5 N	345.2	54.5	55.2	55.3	55.4	56.3	57.1	57.4	58.3	58.7	59.1	59.3
16	63.3 N	342.6	58.5	58.3	58.1	57.9	57.9	58.0	58.2	58.3	58.3	58.3	58.4
17	63.0 N	341.4	57.4	56.4	55.5	55.3	54.6	54.4	54.4	54.2	54.0	54.2	54.5
18	62.6 N	340.0	60.3	59.9	59.7	59.5	59.5	59.5	59.5	60.2	60.4	61.0	61.4
19	63.6 N	338.0	59.5	59.4	59.3	59.3	59.3	59.3	59.2	59.1	59.2	58.8	59.1
28	62.5 N	333.7	64.3	64.2	64.0	63.8	63.8	63.7	63.8	63.9	64.2	64.1	63.8
29	60.7 N	328.8	64.5	64.4	64.5	64.4	64.5	64.7	64.8	65.0	65.2	65.4	65.5
30	59.3 N	325.8	67.4	67.4	67.3	67.3	67.2	67.2	67.2	67.2	67.3	67.2	66.8
31	57.9 N	325.6	65.8	65.6	65.6	65.3	65.3	65.3	65.3	65.3	65.3	65.4	65.4
Aug. 1	58.3 N	324.2	61.1	60.2	59.3	58.8	58.2	58.0	57.7	57.3	57.2	57.1	56.9
2	58.3 N	321.3	56.2	56.9	56.9	57.0	57.0	57.0	57.1	57.1	57.2	57.2	57.2
3	57.9 N	314.5	58.9	59.1	59.2	59.3	59.4	59.7	59.9	59.4	59.2	59.3	59.3
4	54.5 N	311.0	54.5	54.3	54.1	54.1	54.3	55.0	55.3	55.8	56.1	56.4	57.1
5	51.6 N	310.4	61.9	62.0	62.0	62.1	62.4	62.9	63.1	63.2	63.4	63.4	63.7
6	48.4 N	311.8	64.6	64.6	64.5	64.7	64.9	64.9	65.0	64.9	65.0	65.7	65.6
7	45.9 N	312.1	67.1	67.0	67.1	67.2	67.2	67.2	67.2	67.4	67.4	67.3	67.1
8	43.2 N	313.0	66.4	66.3	66.2	66.0	65.9	66.2	66.4	66.5	66.5	66.6	66.8
9	42.2 N	312.7	66.4	66.2	66.1	65.8	66.1	66.3	66.4	66.5	66.7	67.3	67.4
10	39.8 N	311.1	65.8	65.3	64.6	63.9	63.5	62.9	62.2	60.6	61.6	61.4	60.9
11	38.6 N	311.2	61.6	61.5	61.4	61.3	61.5	61.7	61.9	62.0	62.2	62.4	62.5
12	37.0 N	311.6	63.7	63.6	63.5	63.5	63.5	63.6	63.8	64.2	64.3	64.4	64.5
13	36.8 N	313.4	63.5	63.5	63.3	63.0	62.7	62.6	62.6	62.5	62.5	62.5	62.5
14	35.2 N	315.6	61.6	61.6	61.2	60.8	60.8	60.8	60.9	61.1	61.3	61.6	61.7
15	33.6 N	317.7	60.8	60.7	60.6	60.6	60.6	60.7	60.9	61.1	61.5	61.6	61.8
16	31.2 N	318.8	62.8	62.8	62.7	62.8	62.8	62.8	63.2	63.6	63.7	64.1	64.6
17	29.8 N	319.4	65.0	64.9	64.8	64.7	64.7	64.7	64.7	64.9	65.0	65.1	65.2
18	27.9 N	320.5	64.8	64.7	64.5	64.1	63.8	63.9	64.0	64.3	64.6	64.7	64.7
19	25.7 N	321.0	63.7	63.6	63.1	62.8	62.7	62.8	62.9	63.0	63.6	63.7	63.7
20	24.0 N	320.4	63.9	63.8	63.7	63.3	63.2	63.4	63.6	63.7	63.7	63.8	63.7
21	21.8 N	320.4	64.1	64.1	63.9	63.6	63.5	63.4	63.5	63.9	63.9	64.0	64.0
22	19.2 N	321.5	63.5	63.0	62.7	62.3	62.2	62.2	62.2	62.3	62.5	62.5	62.6
23	16.6 N	322.2	61.1	60.8	60.5	60.1	59.9	59.9	59.9	60.0	60.1	60.4	60.8
24	15.8 N	322.1	60.2	60.1	59.7	59.6	59.4	59.4	59.5	59.9	60.0	58.2	60.2
25	14.9 N	321.8	60.1	59.9	59.8	59.4	59.0	58.9	59.1	59.3	59.8	59.9	60.7
26	13.9 N	322.0	60.8	60.6	59.9	59.9	60.0	59.9	60.2	60.5	60.7	61.0	61.4
27	13.4 N	322.0	61.8	61.7	60.9	60.8	60.8	60.8	60.8	61.4	61.8	62.4	61.9
28	11.9 N	322.2	60.4	60.2	59.4	59.3	59.3	59.3	59.3	59.5	60.3	60.4	60.4
29	10.8 N	322.6	60.4	60.3	59.7	59.5	59.4	59.5	59.5	60.0	60.4	60.7	61.3
30	9.5 N	322.8	60.7	60.4	60.3	60.3	60.2	60.3	60.4	61.0	61.4	61.5	61.6

pressure, Carnegie, 1928-29

mean hour, 700 + tabular value													Mean
11	12	13	14	15	16	17	18	19	20	21	22	23	
60.2	60.1	60.1	60.0	60.0	60.0	60.0	60.1	60.1	60.1	60.1	60.1	60.0	760.21
60.1	60.1	60.2	60.1	60.1	60.3	59.9	60.0	60.1	60.1	60.0	59.9	59.4	759.82
57.1	57.1	57.1	57.2	57.0	57.1	57.2	57.2	57.1	56.9	57.0	57.1	57.1	757.63
58.2	58.3	58.1	58.1	58.0	57.8	57.7	57.6	57.8	58.0	57.8	57.7	57.1	757.61
57.9	57.8	58.0	58.1	58.1	58.1	58.1	58.3	58.5	58.9	58.9	58.8	59.1	757.86
61.5	61.6	61.9	62.0	62.3	62.5	62.0	63.0	63.3	63.7	63.0	64.1	64.3	761.48
66.0	66.0	66.0	66.0	66.0	65.8	65.7	65.7	65.6	65.7	65.5	65.0	64.9	765.28
58.7	58.1	57.8	57.0	57.2	55.6	55.0	54.4	54.1	53.9	53.7	53.4	53.0	758.26
52.1	52.5	52.9	53.5	54.2	54.0	54.1	54.2	54.1	54.6	55.1	55.1	55.2	753.00
56.1	56.3	56.4	56.7	56.7	56.8	56.8	56.8	57.0	57.5	57.6	57.6	57.6	756.20
58.9	58.9	58.6	58.3	58.2	58.0	57.8	57.7	57.6	57.5	57.4	57.0	57.1	757.90
54.0	53.4	53.1	52.9	52.9	52.5	52.4	52.0	51.8	51.9	51.5	51.0	50.9	753.73
51.0	50.6	50.3	50.2	49.9	49.2	49.4	49.1	49.0	49.0	49.1	49.3	49.8	750.28
54.3	54.7	55.2	55.7	56.0	56.1	56.5	57.0	57.3	58.0	58.2	58.6	58.9	754.40
59.7	60.0	60.0	60.0	60.1	60.2	60.4	60.8	61.0	61.2	61.2	61.2	61.2	759.81
60.2	60.1	59.9	59.1	58.9	58.8	58.5	58.4	58.3	58.1	58.0	58.0	57.9	759.72
58.3	58.2	58.2	58.2	58.2	58.3	58.9	59.1	59.4	60.0	60.1	60.2	60.6	758.35
62.0	61.9	61.6	61.5	61.5	61.2	61.4	61.3	61.4	61.8	62.0	62.0	61.9	761.47
61.2	61.1	60.4	60.3	60.1	60.1	60.1	60.1	60.1	60.1	60.2	60.1	60.1	760.75
56.4	55.4	54.1	53.6	52.8	52.3	52.0	52.1	52.5	52.9	53.5	53.8	53.8	755.66
52.0	51.7	51.1	50.9	51.1	51.7	52.0	52.4	52.7	52.9	52.9	52.9	52.8	752.47
50.4	50.2	50.2	50.3	50.5	50.5	50.7	50.8	50.9	51.0	51.0	50.9	50.7	751.04
47.8	47.9	47.9	47.8	47.8	47.7	47.5	47.1	46.8	46.3	46.2	46.2	47.7	748.06
51.0	51.1	50.9	51.0	50.8	50.4	49.8	49.0	48.7	47.9	47.0	46.9	46.9	749.18
56.3	56.3	56.3	56.2	56.1	56.2	56.4	56.8	56.7	56.7	56.7	56.8	56.4	756.58
58.8	59.2	59.9	60.2	61.0	61.1	61.2	61.5	61.0	62.1	62.9	63.1	63.1	759.17
66.1	66.0	65.9	65.8	65.7	65.4	65.1	65.0	64.6	64.5	64.6	64.4	64.2	764.89
67.3	67.2	66.8	66.3	66.3	66.0	65.6	65.3	65.2	65.2	64.9	64.4	64.3	766.08
60.5	60.3	60.1	59.7	59.3	59.0	58.5	58.0	57.5	57.1	56.5	56.3	55.8	759.26
56.1	56.2	56.3	56.3	56.4	56.4	56.5	56.6	56.5	56.4	56.4	56.3	56.2	755.72
54.9	54.4	53.5	52.3	50.4	49.5	50.4	50.6	50.9	51.2	51.1	50.6	50.6	753.32
48.9	48.8	48.3	48.2	47.9	47.7	48.1	48.2	48.3	48.3	48.9	49.2	49.3	749.10
51.1	51.1	51.2	51.2	51.2	51.2	51.3	51.9	52.4	52.9	53.3	53.9	54.3	751.17
59.4	59.6	59.0	60.1	60.1	60.1	60.2	60.2	60.2	60.2	59.6	59.3	59.2	758.49
58.6	58.6	58.6	58.6	58.6	58.6	58.6	58.5	58.4	58.3	58.1	58.1	57.9	758.32
55.2	55.4	55.7	56.0	56.4	57.3	57.6	58.4	59.3	59.5	59.8	60.3	60.3	756.50
61.5	61.5	61.5	61.4	61.2	60.6	60.5	60.3	60.3	60.1	60.0	59.7	59.7	760.38
59.2	59.2	59.2	59.3	59.3	59.1	59.3	59.3	59.4	59.4	59.5	59.6	59.7	759.29
64.3	64.3	64.3	64.3	64.3	64.3	64.3	64.4	64.3	64.4	64.5	64.6	64.6	764.19
65.8	66.0	66.1	66.2	66.3	66.4	66.5	66.5	66.8	66.9	67.2	67.3	67.4	765.73
66.4	66.3	66.2	66.2	66.1	66.1	66.1	66.1	66.2	66.1	66.1	66.1	65.9	766.64
65.2	65.1	65.0	64.7	64.4	64.1	64.0	63.6	63.1	62.7	62.5	62.0	61.7	764.49
56.6	56.4	56.2	56.1	55.6	55.3	55.3	55.5	55.7	55.7	56.0	56.2	56.2	757.02
57.1	57.1	57.0	56.5	56.4	56.4	56.5	56.8	57.0	57.1	58.0	58.2	58.7	757.07
59.2	58.8	58.1	57.7	57.2	56.8	56.3	56.1	55.4	55.3	55.2	55.1	55.0	757.87
57.3	57.9	58.1	58.9	59.1	59.6	60.0	60.2	60.6	60.9	61.1	61.2	61.7	757.65
63.9	64.0	64.0	64.0	64.1	64.2	64.2	64.3	64.4	64.7	64.7	64.7	64.7	763.58
65.6	65.6	65.5	65.5	65.6	65.7	66.2	66.3	66.5	66.6	66.7	66.9	67.1	765.59
66.9	66.7	66.7	66.6	66.5	66.5	66.4	66.5	66.6	66.9	67.0	66.7	66.5	766.90
66.7	66.6	66.5	66.4	66.4	66.4	66.4	66.5	66.5	66.9	66.8	66.7	66.5	766.46
67.3	66.7	66.6	66.6	66.6	66.8	66.6	66.6	66.5	66.7	66.5	66.4	66.1	766.55
60.7	60.7	60.5	60.5	60.6	60.9	60.9	61.3	61.4	61.6	62.1	61.9	61.6	761.98
62.6	62.6	62.6	62.8	62.7	62.9	63.2	63.4	63.5	63.8	63.8	63.8	63.7	762.56
64.3	64.2	64.1	63.9	63.7	63.6	63.6	63.5	63.5	63.6	63.8	63.7	63.7	763.82
62.2	61.7	61.7	61.7	61.6	61.6	61.4	61.6	61.6	61.8	61.8	61.8	61.7	762.22
61.7	61.6	61.6	61.4	61.4	61.0	60.8	60.8	60.8	61.0	61.2	61.1	60.9	761.20
61.7	61.7	61.7	61.7	61.7	61.7	61.9	61.8	61.8	62.2	62.8	62.8	62.8	761.55
64.7	64.7	64.7	64.7	64.5	64.5	64.5	64.5	64.7	64.7	64.9	65.0	65.1	764.04
65.5	65.3	65.2	64.9	64.8	64.7	64.7	64.7	64.8	64.9	65.0	65.0	64.8	764.92
64.7	64.6	64.6	64.2	63.8	63.7	63.6	63.6	63.6	63.7	63.8	64.0	63.8	764.16
63.7	63.4	63.4	63.2	63.0	62.9	63.0	63.3	63.6	63.7	63.9	64.0	63.9	763.36
64.0	63.9	63.8	63.1	63.0	62.9	63.0	63.2	63.7	63.8	64.0	64.1	64.1	763.60
64.0	63.9	63.8	63.3	63.2	63.0	63.0	63.0	63.0	63.2	63.6	63.7	63.8	763.60
62.2	62.1	61.7	61.4	61.2	61.1	61.0	61.0	61.0	61.2	61.5	61.6	61.4	761.93
60.6	60.4	60.0	59.9	59.6	59.3	59.2	59.4	59.9	60.0	60.3	60.5	60.5	760.13
60.2	60.1	59.6	59.4	59.2	59.0	58.8	59.0	59.5	59.8	60.1	60.3	60.2	759.64
60.7	60.6	60.5	59.9	59.7	59.5	59.6	59.7	59.8	60.1	60.6	60.9	60.9	759.93
61.2	60.9	60.9	60.7	60.2	60.0	60.1	60.5	60.8	61.0	61.7	61.9	61.9	760.70
61.4	61.3	60.6	60.4	60.0	59.7	59.6	59.7	60.3	60.4	60.5	60.8	60.8	760.86
60.4	59.8	59.4	59.2	58.8	58.6	58.8	58.8	59.2	59.4	60.3	60.4	60.4	759.64
61.3	60.5	59.7	59.4	59.4	59.4	59.7	60.3	60.5	60.5	61.3	61.5	61.2	760.22
61.5	61.3	60.6	60.3	60.3	60.2	60.2	60.4	60.7	61.4	61.8	62.3	62.3	760.89

Table 77. Hourly values of atmospheric

Date	Latitude	Longitude east	Values in mm at local 00	01	02	03	04	05	06	07	08	09	10
1928	°	°											
Aug. 31	8.2 N	323.8	62.0	61.5	60.7	60.6	60.8	60.9	61.3	61.5	62.2	62.4	62.4
Sep. 1	9.4 N	323.3	62.0	61.4	61.3	60.4	60.3	60.4	60.6	60.7	61.3	61.4	61.3
2	9.8 N	323.3	60.4	60.1	59.9	59.6	59.6	59.5	59.5	60.3	60.5	60.5	60.5
4	11.4 N	322.0	58.9	58.7	58.0	58.1	58.1	58.6	58.7	58.8	58.9	59.0	59.0
5	11.6 N	319.2	58.7	58.5	58.2	58.2	58.3	58.5	58.8	59.6	59.6	59.6	59.7
6	11.7 N	317.4	59.7	59.6	59.0	58.9	59.2	59.3	59.7	60.1	60.2	60.3	60.4
7	11.3 N	315.8	59.0	58.7	58.4	58.4	58.7	58.8	59.2	59.6	59.7	59.7	59.0
8	11.6 N	314.9	57.9	57.8	57.7	57.8	58.0	58.3	58.8	59.6	59.7	59.8	59.8
9	11.8 N	313.9	60.5	59.9	59.8	59.7	59.8	59.8	59.9	60.5	60.9	61.0	61.0
10	12.2 N	312.2	60.2	59.8	59.6	59.2	58.9	58.8	58.9	59.3	59.7	59.8	59.7
11	13.2 N	310.3	59.4	59.1	58.4	58.1	58.1	58.5	59.1	60.0	60.2	60.2	60.2
12	13.2 N	309.5	59.5	59.1	58.8	58.7	59.0	59.2	59.5	60.1	60.5	60.6	60.6
13	13.3 N	307.6	58.9	58.3	58.1	58.0	58.2	58.2	58.6	59.1	59.2	59.6	59.9
14	13.0 N	305.7	58.3	59.1	57.9	58.0	58.1	58.6	59.0	59.1	59.2	59.3	59.2
15	12.9 N	303.7	59.3	59.0	59.0	59.0	59.1	59.2	59.7	59.9	60.3	60.6	60.6
16	13.0 N	301.5	60.2	60.0	59.8	59.6	59.6	59.7	60.0	60.2	60.4	61.0	61.2
Oct. 2	14.7 N	298.6	61.0	60.6	60.3	60.1	60.1	60.2	60.4	60.9	61.1	61.9	61.1
3	14.8 N	296.4	60.1	59.8	59.2	59.0	58.9	59.0	59.5	59.9	60.1	60.6	60.9
4	15.0 N	293.9	59.9	59.1	58.8	58.9	59.0	59.0	59.0	59.9	60.1	60.6	61.5
5	15.3 N	291.8	59.4	59.0	58.8	58.7	58.8	59.1	59.6	59.8	60.0	60.3	60.4
6	15.2 N	288.8	60.0	59.4	58.9	58.7	58.3	58.9	59.1	59.2	59.8	60.0	60.0
7	14.5 N	286.0	59.8	59.4	58.9	58.7	58.7	58.8	59.0	59.1	59.9	60.0	60.1
26	6.7 N	280.1	56.1	55.8	55.6	55.4	55.7	56.3	57.2	57.4	59.2	59.1	57.9
27	5.7 N	279.9	56.9	56.3	56.1	56.0	56.3	56.4	56.8	57.4	57.6	58.2	58.3
28	4.3 N	280.2	57.3	56.9	56.4	56.2	56.3	56.4	57.1	57.6	58.4	58.2	58.6
29	4.1 N	280.1	57.2	56.7	56.4	56.3	56.3	56.3	56.6	57.0	57.9	57.9	57.5
30	2.9 N	279.9	56.9	56.6	56.1	56.1	56.1	56.3	57.1	57.7	58.5	58.9	58.8
31	4.5 N	278.1	58.1	57.9	57.2	57.2	57.3	57.4	58.0	58.3	59.1	59.3	59.2
Nov. 1	6.1 N	277.0	57.9	57.4	57.0	56.9	57.0	57.1	57.9	58.1	58.5	58.9	58.7
2	4.6 N	277.7	58.1	57.5	57.2	57.1	57.3	57.3	58.1	58.4	58.9	59.3	59.5
3	3.7 N	278.5	59.1	58.3	58.3	58.3	58.4	58.5	59.0	59.2	59.9	60.0	59.9
6	0.8 N	278.8	61.4	61.2	61.2	61.2	61.5	61.5	61.7	62.3	62.7	62.7	62.6
7	0.5 S	278.0	61.2	60.9	60.8	60.5	60.6	60.7	60.7	61.5	61.7	61.7	61.5
8	1.5 S	277.7	61.2	60.9	60.4	60.2	60.3	60.6	60.9	61.8	62.2	62.4	62.4
9	1.3 S	275.2	61.4	60.8	60.3	60.3	60.4	60.9	61.3	62.2	62.5	62.7	62.5
10	1.6 S	273.0	61.4	61.2	60.4	60.4	60.4	60.8	61.3	61.5	62.2	62.4	62.5
11	1.9 S	271.0	62.1	61.6	61.3	61.2	61.3	61.5	62.0	62.3	62.6	62.8	62.8
12	1.3 S	268.7	62.2	61.9	61.6	61.5	61.5	61.9	62.1	62.3	63.0	63.0	63.0
13	1.5 S	266.9	60.9	60.5	60.2	60.1	60.2	60.4	61.1	61.5	62.0	62.1	62.2
14	1.8 S	265.7	60.7	60.5	60.3	60.3	60.6	60.7	61.1	61.8	62.3	62.5	62.4
15	2.5 S	264.2	61.3	60.9	60.8	60.7	60.7	61.1	61.3	61.7	62.1	62.2	62.0
16	3.1 S	261.8	60.5	60.1	59.7	59.6	59.7	60.2	60.8	61.6	61.9	62.2	62.1
17	3.3 S	260.2	59.8	59.3	59.0	58.6	58.7	59.1	59.4	60.0	60.3	60.4	60.5
18	4.0 S	257.4	60.1	59.9	59.5	59.0	59.1	59.3	60.0	60.1	60.9	61.0	60.9
19	4.6 S	254.9	59.6	59.2	58.8	58.7	58.6	58.7	59.2	59.7	59.7	59.7	59.0
20	7.0 S	253.1	58.9	58.6	58.5	58.4	58.5	58.8	59.3	59.8	60.0	60.5	60.6
21	9.2 S	251.6	60.0	59.6	59.2	59.2	59.4	60.1	60.4	61.1	61.8	61.9	61.9
22	12.0 S	249.8	61.9	61.1	61.0	60.9	60.9	61.1	61.8	62.2	62.9	62.9	62.9
23	14.2 S	248.1	62.5	62.0	61.6	61.6	61.8	62.0	62.3	63.2	63.7	63.7	63.7
24	16.7 S	247.0	62.7	62.3	61.7	61.5	61.4	61.6	62.2	62.8	63.2	63.4	63.5
25	19.2 S	245.9	63.3	63.1	62.3	62.1	62.2	62.3	62.6	63.5	64.1	64.2	64.3
26	21.6 S	245.6	64.6	64.3	63.8	63.5	63.4	63.4	64.4	64.7	65.3	65.2	65.0
27	23.3 S	245.2	64.0	63.8	63.5	63.4	63.4	63.7	64.0	64.6	64.8	64.9	64.9
28	24.8 S	244.7	65.2	64.7	64.3	64.3	64.6	64.9	65.1	65.3	66.0	66.1	66.2
29	26.6 S	244.7	66.6	66.3	66.2	66.1	66.3	66.7	67.0	67.4	67.6	67.6	67.6
30	28.1 S	244.9	66.9	66.5	66.4	66.3	66.4	66.5	66.6	67.1	67.0	66.8	66.6
Dec. 1	29.2 S	245.2	66.1	65.9	65.3	65.1	65.1	65.5	65.7	65.8	65.9	66.0	66.0
2	30.6 S	245.7	67.1	66.5	66.5	66.4	66.5	67.0	67.3	68.0	68.0	68.0	68.0
13	28.2 S	250.8	66.7	66.3	66.0	66.0	66.2	66.2	66.5	67.2	67.2	67.3	67.3
14	29.4 S	251.1	65.8	65.3	65.1	64.5	64.3	64.4	64.9	65.0	65.1	65.0	64.9
15	31.1 S	250.5	63.2	62.8	62.2	61.4	61.2	61.5	61.9	61.3	61.3	60.8	60.8
16	32.0 S	249.1	61.3	61.3	61.2	61.2	61.2	61.6	61.8	62.4	62.8	62.9	63.0
17	31.8 S	250.6	64.6	64.6	64.5	64.2	64.2	64.3	64.6	65.2	65.3	65.2	65.1
18	31.9 S	251.0	65.4	65.3	65.2	65.2	65.2	65.2	65.3	65.4	65.3	65.4	65.4
19	32.5 S	252.6	64.3	64.2	63.9	63.9	64.0	64.3	64.4	65.1	65.1	65.2	65.2
20	34.0 S	253.4	65.3	65.2	64.9	64.6	64.7	64.9	65.2	65.5	65.5	65.5	65.4
21	35.3 S	254.6	66.4	66.4	66.3	66.2	66.2	66.3	66.6	66.9	67.4	67.5	67.6
22	36.9 S	255.9	69.3	69.2	69.1	69.1	69.1	69.2	69.4	70.1	70.2	70.2	70.2
23	38.7 S	257.1	70.4	70.3	70.2	70.2	70.3	70.4	70.6	71.1	71.4	71.5	71.5
24	39.9 S	259.0	72.6	72.5	72.4	72.4	72.3	72.3	72.6	72.9	73.0	73.0	73.0
25	40.3 S	261.0	73.1	72.6	72.5	72.5	72.5	72.7	72.7	72.8	73.0	73.0	73.1

pressure, Carnegie, 1928-29--Continued

mean hour, 700 + tabular value													Mean
11	12	13	14	15	16	17	18	19	20	21	22	23	
													mm
63.2	62.3	61.9	61.1	61.2	60.9	60.9	61.3	61.5	61.6	62.3	62.3	62.2	761.59
61.2	60.5	60.4	59.8	59.9	59.9	59.9	60.4	60.5	60.8	60.9	61.0	61.0	760.72
60.5	60.4	59.7	59.5	59.4	59.4	59.5	60.3	60.4	60.7	60.9	60.5	60.5	760.09
59.0	58.8	58.7	58.3	58.0	58.0	58.1	58.6	58.8	59.1	59.1	59.1	59.1	758.64
59.6	59.5	59.1	58.8	58.7	58.7	58.8	59.3	59.5	59.7	59.9	59.9	59.8	759.13
59.8	59.4	59.1	58.8	58.8	58.8	58.9	59.4	59.7	59.8	59.8	59.8	59.4	759.50
58.8	57.9	57.7	57.6	57.7	57.8	58.0	58.4	58.7	58.9	58.8	58.7	58.3	758.60
59.9	59.4	58.9	58.8	58.7	58.7	58.8	59.3	59.8	59.9	60.7	60.8	60.7	759.15
60.8	60.6	60.0	59.9	59.7	59.7	59.8	60.0	60.4	60.8	61.0	60.9	60.8	760.30
59.2	58.6	58.1	57.8	57.5	57.7	57.9	57.9	58.1	59.0	59.1	59.3	59.4	758.90
60.2	60.0	59.5	59.1	59.0	59.1	59.1	59.4	59.9	60.1	60.3	60.4	60.1	759.48
60.2	59.9	59.3	58.9	58.5	58.6	59.0	59.1	59.3	59.7	59.9	59.8	59.5	759.47
59.2	58.3	59.1	57.8	57.5	57.6	58.0	58.1	58.2	59.1	59.2	59.1	59.0	758.55
59.1	58.9	58.4	58.3	58.2	58.2	58.4	58.7	59.1	59.5	59.9	60.0	59.9	758.85
60.6	60.1	59.5	59.3	59.2	59.2	59.3	59.5	60.1	60.2	60.9	60.5	60.2	759.76
61.1	60.9	60.7	59.9	59.7	59.3	59.4	59.8	60.1	60.4	60.8	60.9	60.6	760.22
60.8	60.4	60.0	59.8	59.6	59.2	59.3	59.3	59.6	60.0	60.1	60.3	60.2	760.26
60.6	60.0	59.4	59.0	58.9	59.1	59.5	59.5	59.3	59.2	59.1	59.9	59.9	759.60
60.9	60.0	59.2	58.7	58.5	58.5	58.3	58.9	59.0	59.1	59.3	59.7	59.8	759.40
60.0	59.8	59.1	58.9	58.7	58.6	58.2	58.3	58.7	59.0	59.9	60.2	60.1	759.31
59.8	59.4	59.0	58.4	58.2	58.2	58.3	58.6	58.8	59.5	59.6	60.0	59.9	759.17
59.9	59.1	58.8	58.1	57.6	57.4	57.5	57.9	58.1	58.7	58.9	59.0	59.0	758.85
57.6	57.7	57.3	56.3	55.4	55.5	55.3	55.3	55.7	57.0	57.3	57.3	57.2	756.69
58.2	57.8	57.3	57.0	56.6	56.2	56.2	56.4	57.0	57.3	57.4	57.8	57.8	757.05
58.4	58.0	57.3	56.4	56.1	55.9	56.1	56.4	56.6	57.2	57.7	57.6	57.5	757.11
57.1	56.2	55.8	55.0	54.7	54.7	55.0	55.3	56.1	56.5	57.1	57.2	57.2	756.42
58.4	57.9	57.1	56.2	56.0	56.1	56.3	56.9	57.3	58.1	58.5	58.5	58.4	757.28
58.8	58.3	57.9	57.0	57.1	56.6	56.1	57.0	57.2	57.8	58.4	58.5	58.4	757.84
58.2	57.8	57.3	56.8	56.4	56.4	56.9	57.2	57.4	57.9	58.5	58.5	58.3	757.63
59.1	58.7	58.1	57.4	57.4	57.9	58.2	58.6	59.2	60.0	60.1	60.1	59.8	758.47
59.4	58.8	58.3	58.0	57.7	57.7	57.9	58.3	59.1	59.3	59.7	59.8	59.6	758.85
62.0	61.5	61.3	60.5	60.3	59.8	60.0	60.4	60.5	61.1	61.5	61.5	61.5	761.32
61.1	60.6	60.0	59.5	59.0	58.7	59.0	59.4	59.7	60.4	60.9	61.2	61.3	760.52
62.1	61.5	61.1	60.5	60.4	60.3	60.4	60.5	61.2	61.5	62.0	61.9	61.8	761.19
62.3	61.5	60.9	60.3	59.7	59.7	59.9	60.2	60.3	61.1	61.4	61.5	61.5	761.07
62.4	62.1	61.4	60.7	60.3	60.2	60.2	60.2	60.8	61.2	61.9	62.1	62.2	761.26
62.3	62.0	61.3	60.9	60.3	60.2	60.3	60.7	61.1	62.1	62.3	62.3	62.2	761.64
62.4	62.0	61.1	60.2	60.0	59.9	60.0	60.2	60.7	61.1	61.2	61.3	61.2	761.47
62.1	61.5	61.0	60.4	59.9	59.9	60.1	60.3	60.4	61.0	61.5	61.5	61.4	760.92
61.8	61.6	60.9	60.4	59.9	59.8	59.9	60.0	60.9	61.0	61.5	61.7	61.6	761.01
61.7	61.5	60.6	59.6	58.9	58.7	58.7	59.0	59.6	60.1	60.7	60.6	60.6	760.63
61.6	61.1	60.4	59.7	59.2	58.8	58.9	59.1	59.2	59.4	60.0	60.1	60.1	760.25
60.3	60.0	59.8	59.1	58.8	58.4	58.7	59.1	59.2	59.9	60.1	60.2	60.2	759.54
60.6	60.0	59.4	58.9	58.3	58.1	58.2	58.4	58.9	59.3	59.4	59.9	59.8	759.54
58.7	58.1	57.7	57.1	57.1	57.3	57.5	57.7	58.7	58.8	58.8	58.9	59.0	758.60
59.9	59.4	59.0	58.8	58.4	58.5	58.6	59.1	59.7	60.1	60.6	60.6	60.3	759.37
61.3	61.2	60.5	60.3	60.0	60.0	60.2	60.4	60.7	61.5	61.6	62.1	62.1	760.69
62.6	61.9	61.4	61.0	60.8	60.7	60.8	61.0	61.7	62.0	62.6	62.8	62.8	761.74
63.3	63.2	62.2	61.7	62.3	61.0	61.5	61.6	61.7	62.3	62.7	63.1	63.2	762.41
63.5	63.3	62.9	62.4	62.3	62.1	62.0	62.2	62.3	62.5	63.1	63.3	63.5	762.57
64.3	64.2	63.8	63.5	63.1	63.2	63.3	63.4	63.8	64.3	64.5	64.7	64.9	763.54
64.7	64.7	64.3	63.9	63.8	63.8	63.9	64.3	64.8	64.9	65.0	64.9	64.5	764.38
64.8	64.8	64.7	64.1	64.0	64.0	64.1	64.2	64.7	65.1	65.6	65.7	65.5	764.43
66.3	66.1	65.8	65.7	65.4	65.4	65.4	65.5	65.8	66.4	66.5	66.6	66.6	765.59
67.5	67.1	66.7	66.6	66.4	66.2	66.4	66.5	66.7	67.0	67.3	67.5	67.4	766.86
66.3	66.1	65.9	65.5	65.3	65.2	65.3	65.5	66.2	66.2	66.6	66.9	66.5	766.28
66.0	66.0	66.0	65.8	65.8	65.8	65.9	65.9	66.1	66.4	67.0	67.2	67.2	765.97
68.0	67.7	67.3	67.1	67.0	67.0	67.1	67.5	68.0	68.0	68.1	68.2	68.1	767.43
67.2	67.1	66.4	66.1	65.6	65.4	65.4	65.5	66.0	66.1	66.1	66.2	66.1	766.34
64.6	64.3	64.2	64.2	63.8	63.4	63.3	63.3	64.0	64.2	64.1	64.2	63.5	764.39
60.5	60.3	60.1	59.8	59.8	59.8	59.8	60.0	60.1	60.2	60.3	60.9	61.2	760.88
63.2	63.2	63.1	63.2	63.1	63.0	63.0	63.1	63.4	64.0	64.3	64.4	64.5	762.76
65.3	65.3	65.2	65.2	65.1	64.7	65.1	65.3	65.4	65.9	66.2	66.2	65.7	765.10
65.3	65.2	64.9	64.6	64.5	64.4	64.2	64.2	64.3	64.4	64.5	64.7	64.6	764.92
65.1	65.0	64.7	64.3	64.2	64.1	64.0	64.2	64.4	64.8	65.2	65.4	65.4	764.60
65.3	65.3	65.2	65.2	65.2	65.1	65.1	65.2	65.5	65.9	66.2	66.4	66.4	665.36
68.2	68.2	68.2	68.1	68.1	68.0	68.1	68.2	68.4	68.9	69.3	69.4	69.4	767.68
70.2	70.1	69.9	69.7	69.7	69.7	69.6	69.6	69.9	70.2	70.4	70.5	70.5	769.80
71.9	72.0	71.8	71.8	71.7	71.7	71.7	71.8	72.0	72.2	72.3	72.6	72.6	771.42
73.0	73.0	72.8	72.7	72.7	72.5	72.6	72.6	72.8	73.2	73.3	73.3	73.3	772.78
73.2	73.2	73.1	72.8	72.7	72.6	72.6	72.6	72.6	73.0	73.2	73.2	73.1	772.85

Table 77. Hourly values of atmospheric

Date	Latitude	Longitude east	Values in mm at local 00	01	02	03	04	05	06	07	08	09	10
1928	°	°											
Dec. 26	40.4 S	262.5	73.1	72.9	72.5	72.5	72.9	73.0	73.1	73.2	73.2	73.2	73.3
27	39.9 S	263.7	73.4	73.3	73.2	73.2	73.2	73.2	73.2	73.2	73.2	73.2	73.2
28	38.4 S	265.8	72.3	72.1	71.8	71.4	71.3	71.2	71.1	71.0	70.8	70.6	70.3
29	36.6 S	267.0	69.0	68.5	68.2	68.1	68.2	68.3	68.4	68.6	69.0	69.1	69.2
30	34.5 S	268.2	69.1	68.9	68.6	68.3	68.3	68.8	69.1	69.2	69.2	69.1	69.1
31	32.5 S	270.0	68.2	68.2	67.6	67.3	67.5	67.9	68.1	68.1	68.1	68.2	68.2
1929													
Jan. 1	32.2 S	270.9	68.1	67.9	67.6	67.5	67.6	67.7	68.1	68.3	68.3	68.4	68.6
2	31.9 S	271.1	68.2	67.9	67.8	67.7	67.7	67.8	67.9	68.3	68.3	68.3	67.8
3	31.9 S	271.7	66.6	66.1	65.9	65.6	65.5	65.6	65.9	65.9	66.0	66.1	66.1
4	31.8 S	272.7	65.3	65.0	64.9	64.6	64.6	64.7	65.0	65.1	65.4	65.7	65.9
5	31.0 S	273.4	65.7	65.4	64.8	64.8	64.8	64.9	65.3	65.7	65.7	65.8	65.7
6	28.9 S	274.7	65.4	65.4	65.2	64.6	64.5	64.9	65.2	65.2	65.3	65.2	65.2
7	27.0 S	276.0	64.9	64.4	64.0	63.9	63.9	64.0	64.2	64.6	64.6	64.9	64.9
8	25.0 S	277.8	63.5	63.3	63.1	63.0	63.3	63.5	63.8	64.3	64.4	64.4	64.4
9	23.1 S	278.8	63.4	63.1	62.6	62.4	62.5	62.6	62.7	63.0	63.0	62.7	62.7
10	21.4 S	279.5	62.1	62.0	61.7	61.6	61.7	62.4	62.5	62.6	63.1	63.0	62.8
11	19.1 S	280.7	62.3	61.9	61.5	61.0	61.1	60.9	61.5	61.6	61.7	61.8	61.7
12	16.7 S	281.4	60.1	59.5	59.1	58.7	58.8	59.0	59.5	59.8	60.4	60.4	60.4
13	14.1 S	282.1	59.5	59.2	58.9	58.6	58.5	58.5	58.8	59.3	59.8	60.0	60.1
14	12.3 S	282.8	59.2	58.7	58.4	58.2	57.9	57.9	58.0	58.5	58.9	58.9	58.9
Feb. 6	11.9 S	281.4	59.6	59.3	59.1	59.0	59.0	59.1	59.3	60.0	60.1	60.3	60.3
7	10.2 S	280.1	60.4	60.1	59.7	59.7	59.7	59.8	60.1	61.1	61.7	61.8	61.8
8	10.0 S	277.8	60.5	60.2	59.7	59.4	59.3	59.5	59.6	60.0	60.5	60.6	60.6
9	10.4 S	275.8	59.5	59.1	58.7	58.6	58.6	58.8	58.9	59.1	59.4	59.7	59.6
10	10.8 S	275.0	59.3	59.0	58.7	58.5	58.4	58.3	58.6	59.0	59.6	60.3	60.4
11	10.7 S	274.1	60.0	59.4	59.1	58.8	58.7	58.8	59.2	59.9	60.3	60.3	60.2
12	11.0 S	272.6	59.9	59.8	59.4	59.2	59.1	59.1	59.3	59.4	59.9	60.1	60.3
13	12.6 S	270.3	60.0	59.9	59.4	59.1	58.9	58.9	59.0	59.3	59.8	60.1	60.2
14	14.4 S	267.8	60.1	59.9	59.5	59.3	59.3	59.7	60.1	60.3	60.9	61.3	61.2
15	15.8 S	265.1	61.6	61.1	60.9	60.8	60.9	61.0	61.2	61.7	62.2	62.4	62.4
16	15.3 S	262.4	62.1	61.9	61.5	61.2	61.1	61.0	61.4	61.9	62.4	62.8	62.9
17	14.8 S	259.2	62.4	62.0	61.7	61.1	61.1	61.2	61.5	61.9	62.3	62.7	62.9
18	14.3 S	256.7	61.9	61.6	61.1	60.7	60.7	60.9	61.1	61.3	61.7	62.1	61.7
19	13.6 S	254.1	60.4	59.9	59.7	59.6	59.7	59.8	60.0	60.5	60.7	60.8	60.9
20	13.0 S	251.8	59.5	59.0	58.7	58.5	58.5	58.7	59.1	59.7	60.0	60.0	59.9
21	12.5 S	249.9	59.3	58.7	58.5	58.4	58.4	58.6	58.9	59.3	59.8	60.2	60.2
22	12.6 S	247.7	60.4	59.9	59.6	59.6	59.7	59.7	60.0	60.7	61.0	61.3	61.5
23	12.5 S	244.9	60.6	60.1	59.7	59.6	59.7	59.7	60.0	60.5	61.0	61.1	61.0
24	12.7 S	242.4	59.4	59.1	58.7	58.1	58.1	58.2	58.4	58.7	59.4	59.6	59.6
25	12.8 S	240.6	59.5	59.0	58.8	58.7	58.7	59.1	59.3	59.9	60.3	60.3	60.3
26	13.0 S	238.7	59.5	59.1	58.3	58.1	58.1	58.1	58.6	59.0	59.9	60.1	60.2
27	13.5 S	235.9	59.7	59.5	59.1	58.9	58.9	59.1	59.5	59.9	60.5	60.7	60.7
28	14.9 S	233.8	60.2	59.5	59.0	58.9	58.7	58.8	58.9	59.5	59.9	60.1	60.1
Mar. 1	16.5 S	231.9	59.9	59.7	59.3	59.2	59.3	59.7	59.8	60.3	60.7	60.9	60.9
2	17.0 S	230.2	60.9	60.5	60.0	59.9	59.9	59.8	59.8	60.3	60.4	60.7	60.7
3	17.1 S	228.3	61.1	60.7	60.4	60.3	60.2	60.7	60.9	61.2	61.6	61.9	61.7
4	17.2 S	226.7	61.9	61.5	61.1	60.7	60.5	60.7	61.2	61.7	62.1	62.1	61.7
5	17.1 S	224.6	61.1	60.7	60.0	60.0	60.0	60.4	60.7	61.0	61.5	61.6	61.5
6	17.2 S	223.4	60.4	59.7	59.4	59.0	59.0	59.5	59.6	60.1	60.6	60.8	60.6
7	17.4 S	221.1	60.5	60.0	59.8	59.7	59.7	59.9	60.4	60.6	60.9	61.0	60.7
8	17.8 S	219.2	59.5	59.0	58.9	58.7	58.9	59.0	59.7	60.3	60.5	60.6	60.5
9	17.6 S	218.0	60.5	59.9	59.8	59.8	59.9	60.5	60.7	61.3	61.7	61.9	61.8
10	18.0 S	215.9	61.5	60.9	60.6	60.3	60.2	60.6	60.7	61.0	61.5	61.5	61.5
11	18.1 S	214.4	61.3	60.6	60.5	59.8	59.8	59.9	60.4	61.2	61.4	61.4	61.4
12	17.9 S	212.0	60.4	59.9	59.4	59.5	59.5	59.6	59.6	60.2	60.5	60.6	60.6
13	17.5 S	210.4	60.2	59.8	59.6	59.4	59.6	59.6	60.0	60.4	60.6	60.6	60.7
21	16.8 S	209.2	57.0	56.2	56.0	55.9	56.0	56.2	56.4	57.0	57.6	58.0	58.0
22	17.6 S	208.2	57.7	57.2	57.0	56.7	56.7	57.1	57.4	57.8	58.9	59.4	59.2
23	17.2 S	207.3	59.0	58.6	58.2	58.1	58.2	58.5	59.0	59.2	60.0	60.1	60.0
24	16.9 S	206.3	60.2	59.9	59.5	59.5	59.6	59.7	60.1	60.2	61.1	61.2	61.2
25	16.5 S	204.0	60.2	59.5	59.2	59.1	59.0	59.0	58.9	59.3	59.5	59.5	59.3
26	16.1 S	201.6	58.8	57.9	57.5	57.4	57.4	57.6	57.9	58.3	58.3	58.3	58.3
27	15.7 S	199.4	57.5	57.1	56.8	56.5	56.5	56.5	56.5	57.3	57.5	57.5	57.3
28	15.5 S	198.0	57.1	57.0	56.5	56.5	56.1	56.1	56.5	57.1	57.5	57.8	57.5
29	15.3 S	196.7	56.7	56.5	56.3	56.3	56.3	56.6	57.1	57.4	57.8	57.9	57.8
30	14.7 S	194.4	56.7	56.4	56.3	56.1	56.2	56.3	56.7	57.0	57.3	57.3	57.2
31	14.7 S	192.1	57.2	56.9	56.5	56.5	56.6	56.8	57.1	57.5	57.9	58.3	57.9
Apr. 1	14.4 S	190.0	57.8	57.3	57.1	56.7	56.7	56.9	57.3	57.6	57.9	58.2	58.3
22	12.7 S	188.4	58.1	57.9	57.5	57.1	57.0	57.0	57.1	57.6	58.1	58.9	58.9
23	11.3 S	188.4	58.7	57.6	57.3	57.2	57.4	57.6	57.6	58.3	58.4	58.7	58.7
24	8.7 S	189.0	57.8	57.4	57.0	56.9	57.0	57.3	57.7	58.1	58.5	58.2	57.9

pressure, Carnegie, 1928-29--Continued

mean hour, 700 + tabular value													Mean
11	12	13	14	15	16	17	18	19	20	21	22	23	
													mm
73.4	73.4	73.4	73.3	73.3	73.3	73.1	73.1	73.2	73.2	73.7	73.6	73.5	773.18
73.2	73.2	73.1	73.1	73.0	72.7	72.5	72.3	72.3	72.5	72.5	72.4	72.3	772.94
70.2	70.2	70.2	70.0	69.6	69.3	69.2	69.2	69.2	69.2	69.2	69.2	69.1	770.32
69.2	69.1	69.0	69.0	68.9	68.8	68.4	68.3	68.3	68.8	69.0	69.1	69.1	768.73
69.2	69.2	69.2	68.9	68.5	68.3	68.2	68.2	68.2	68.4	68.7	68.6	68.4	768.74
68.2	68.1	68.0	67.9	67.5	67.2	67.3	67.4	67.6	68.0	68.3	68.3	68.2	767.89
68.5	68.5	68.2	67.7	67.7	67.7	67.6	67.8	68.3	68.4	68.5	68.6	68.6	768.09
67.8	67.3	67.2	66.9	66.6	66.4	66.4	66.6	66.9	66.9	66.9	66.8	66.8	767.38
66.0	65.9	65.8	65.7	65.1	64.9	64.9	64.9	65.0	65.1	65.5	65.5	65.4	765.62
66.0	66.1	66.0	65.9	65.4	65.3	65.1	65.1	65.2	65.8	65.9	65.9	65.9	765.41
65.7	65.7	65.5	65.5	65.2	64.8	64.6	64.5	64.6	64.9	65.4	65.4	65.5	765.24
65.3	65.3	65.2	64.9	64.5	64.3	64.2	64.3	64.4	64.7	65.1	65.2	65.1	764.94
64.8	64.5	64.4	63.9	63.6	63.6	63.7	63.7	63.9	64.2	64.3	64.4	63.7	764.21
64.4	64.2	63.7	63.5	62.9	62.5	62.8	62.9	63.2	63.4	63.5	63.6	63.5	763.54
62.6	62.5	62.2	61.6	61.3	61.0	61.0	61.3	61.6	61.9	62.4	62.6	62.5	762.30
62.7	62.6	62.5	62.1	61.6	61.4	61.4	61.4	61.5	61.6	62.4	62.5	62.5	762.14
61.6	61.5	60.8	60.5	60.0	59.5	59.4	59.5	60.3	60.5	60.8	60.7	60.5	760.94
60.3	60.1	59.6	59.1	58.5	58.2	58.2	58.4	58.8	59.3	59.5	59.6	59.6	759.37
59.9	59.5	59.4	59.0	58.5	58.0	57.6	57.9	58.1	58.5	59.3	59.4	59.2	758.98
58.6	58.5	58.4	57.7	57.6	57.5	57.4	57.5	57.6	58.1	58.5	58.6	58.6	758.25
60.2	60.1	59.9	59.7	59.3	59.1	59.1	59.2	59.8	60.1	60.5	60.6	60.6	759.72
61.2	60.9	60.4	59.8	59.3	59.0	59.0	59.4	59.7	60.1	60.5	60.6	60.8	760.28
60.3	60.0	59.5	59.0	58.6	58.3	58.2	58.3	58.4	58.7	59.2	59.4	59.6	759.48
59.5	59.2	58.8	58.6	58.2	57.4	57.4	57.5	57.9	58.4	58.7	59.2	59.3	758.75
60.3	60.1	59.6	59.2	58.8	58.2	58.0	58.1	58.5	58.8	59.3	59.6	60.0	759.11
60.1	59.7	58.9	58.3	57.9	57.9	57.9	58.0	58.2	58.5	59.1	59.5	59.9	759.11
60.3	59.9	59.8	59.4	58.8	58.5	58.2	58.1	58.2	58.4	58.9	59.3	59.9	759.30
60.3	60.2	60.0	59.4	59.1	58.6	58.3	58.5	58.9	59.2	59.9	60.0	60.1	759.46
61.3	61.1	61.0	60.7	60.4	60.0	59.8	60.2	60.3	60.7	61.1	61.6	61.7	760.48
62.6	62.3	62.1	61.5	61.1	60.9	60.9	61.3	61.4	61.8	62.3	62.4	62.4	761.63
62.9	62.8	62.3	61.9	61.4	60.9	60.9	61.2	61.4	62.0	62.3	62.5	62.6	761.89
62.9	62.5	62.1	61.3	61.0	60.4	60.2	60.4	60.8	61.4	61.9	62.1	62.1	761.66
61.6	61.1	60.4	59.9	59.5	59.3	59.5	59.7	59.9	60.5	60.8	60.8	60.7	760.77
60.7	60.1	59.7	59.4	58.9	58.6	58.6	58.7	59.3	59.6	59.7	59.9	59.8	759.79
59.8	59.7	59.3	58.5	57.9	57.7	57.7	58.1	58.6	58.8	59.4	59.6	59.5	759.01
60.0	59.7	59.0	58.5	58.0	57.7	57.8	58.2	58.7	59.4	59.9	60.5	60.6	759.10
61.5	61.0	60.3	59.7	59.4	59.2	59.2	59.4	59.7	60.1	60.5	60.9	60.9	760.22
60.7	60.0	59.5	58.7	58.0	57.8	57.9	58.0	58.5	58.8	59.2	59.6	59.7	759.56
59.4	59.1	58.7	57.9	57.7	57.5	57.5	57.7	58.1	58.5	59.0	59.5	59.7	758.65
60.2	59.9	59.1	58.6	58.1	58.1	58.1	58.1	58.6	59.0	59.1	59.7	59.7	759.18
60.2	60.1	59.8	59.1	58.7	58.5	58.5	58.7	59.1	59.7	59.9	60.0	60.1	759.22
60.6	59.9	59.7	59.0	58.7	58.4	58.6	58.9	59.3	59.8	60.1	60.6	60.6	759.61
59.8	59.7	59.1	58.7	58.2	58.1	58.1	58.6	58.9	59.5	60.1	60.5	60.3	759.30
60.7	60.2	59.9	59.4	59.2	59.1	59.2	59.7	59.9	60.5	61.0	61.2	61.1	760.03
60.5	60.1	59.9	59.8	59.7	59.7	59.8	60.0	60.5	60.8	61.1	61.3	61.3	760.31
61.5	60.9	60.2	60.0	59.9	59.9	60.1	60.6	60.9	61.7	61.9	62.4	62.1	760.95
61.5	61.2	60.6	60.0	60.0	60.0	60.3	60.7	61.1	61.5	61.7	61.8	61.6	761.13
61.3	60.5	59.9	59.5	59.2	59.1	59.2	59.5	59.7	59.9	60.2	60.5	60.6	760.32
60.5	60.0	59.7	59.4	59.2	59.3	59.6	59.9	60.3	60.6	61.0	61.0	60.9	760.00
60.5	59.7	59.4	58.9	58.7	58.7	58.8	59.0	59.6	60.1	60.4	60.4	60.0	759.89
60.2	59.8	59.5	58.9	58.7	58.5	58.6	59.1	59.7	60.0	60.5	60.7	60.6	759.60
61.6	61.1	60.7	60.5	60.4	60.5	60.7	60.9	61.6	61.9	62.1	61.9	61.7	760.98
61.2	60.7	60.4	60.2	60.2	60.5	60.7	61.5	61.5	61.5	61.5	61.5	61.5	760.97
61.2	60.4	60.0	59.7	59.7	59.5	59.5	59.6	60.2	60.6	60.7	60.6	60.6	760.42
60.4	59.6	59.1	58.7	58.4	58.2	58.3	58.9	58.9	59.9	60.2	60.6	60.4	759.64
60.6	60.4	59.6	59.6	59.6	59.6	59.6	59.8	60.2	60.4	60.7	60.9	60.9	760.10
58.0	57.0	57.0	57.1	56.6	56.6	57.4	58.0	58.4	58.9	58.8	58.7	58.4	757.30
58.7	58.1	57.7	57.4	57.2	57.2	57.3	57.7	58.2	58.5	58.9	59.0	59.0	757.92
59.8	59.3	59.0	58.8	58.5	58.6	58.8	59.1	59.3	60.1	60.4	60.5	60.5	759.23
61.0	60.0	59.4	59.4	59.2	59.3	59.5	59.8	60.1	60.7	60.8	61.0	60.4	760.12
59.2	58.8	58.3	58.1	58.0	58.0	58.1	58.2	58.8	59.1	59.3	59.3	59.2	758.95
58.1	57.8	57.4	57.1	57.1	57.1	57.1	57.2	57.3	57.5	57.7	58.2	57.7	757.71
56.9	56.5	56.1	56.0	55.6	56.0	56.1	56.3	56.5	57.1	57.2	57.4	57.3	756.75
57.3	56.7	56.4	56.1	56.1	56.1	56.2	56.5	56.8	57.3	57.3	57.1	57.1	756.78
57.3	57.0	56.5	56.3	56.1	56.0	56.2	56.4	56.6	57.1	57.0	57.0	57.1	756.80
57.1	56.6	56.4	56.2	55.8	55.8	55.9	56.3	56.8	57.3	57.4	57.3	57.3	756.65
57.6	57.1	56.7	56.2	56.1	56.2	56.4	56.9	57.3	58.0	58.2	58.3	58.2	757.18
58.1	57.3	57.7	56.4	56.2	56.2	56.3	56.5	57.1	57.3	57.5	57.9	57.8	757.25
58.7	58.5	57.6	57.4	57.1	57.8	58.1	58.5	59.3	60.2	60.1	59.7	59.1	758.22
58.3	57.6	57.1	56.7	56.5	56.3	56.3	56.7	57.1	57.6	58.3	58.2	58.0	757.59
57.8	57.0	56.6	56.4	55.8	55.8	55.9	56.1	56.5	57.1	57.4	57.5	57.6	757.14

Table 77. Hourly values of atmospheric

Date	Latitude	Longitude east	Values in mm at local 00	01	02	03	04	05	06	07	08	09	10
1929	°	°											
Apr. 25	7.6 S	188.2	57.5	56.9	56.9	56.8	56.7	57.0	57.2	57.8	58.2	58.7	58.6
26	6.7 S	187.6	57.8	57.1	56.6	56.5	56.5	56.6	56.7	57.0	57.6	57.8	57.7
29	1.8 S	186.6	57.1	57.0	56.6	56.4	56.5	56.5	56.6	57.2	57.6	57.9	57.6
May 1	2.5 N	184.9	57.4	57.1	56.7	56.5	56.7	56.8	57.3	57.8	58.0	58.0	57.8
2	4.4 N	183.6	58.0	57.5	57.2	57.0	57.0	57.2	57.6	57.9	58.2	58.7	58.6
3	6.5 N	182.3	57.7	57.3	56.5	56.2	56.3	56.5	56.6	57.4	57.8	58.2	58.0
4	8.2 N	181.1	58.3	57.5	57.3	57.1	57.1	57.3	57.5	58.3	58.7	59.1	59.2
5	10.8 N	180.5	59 0	58.5	58.2	57.7	57.7	58.2	58.4	58.8	59.3	59.7	59.6
Crossed International Date Line													
7	13.5 N	177.4	59.6	59.0	58.7	58.8	59.2	59.4	59.8	56.4	56.7	56.7	56.4
8	15.4 N	174.7	60.2	59.7	59.4	59.4	59.5	59.9	60.4	60.8	60.8	60.9	60.8
9	16.5 N	171.9	59.9	59.6	59.2	59.1	59.1	59.2	59.5	60.0	60.2	60.3	60.2
10	18.5 N	169.0	60.1	59.6	59.4	59.4	59.7	60.2	60.3	60.5	60.8	60.8	60.8
11	19.3 N	166.4	61.0	60.5	60.3	60.2	60.2	60.3	60.5	61.1	61.4	61.5	61.4
12	20.3 N	163.7	61.5	61.5	61.2	60.9	60.9	61.2	61.7	61.9	62.5	62.6	62.7
13	20.2 N	161.2	62.4	61.9	61.7	61.7	61.7	61.8	61.9	62.6	62.7	62.7	62.7
14	19.5 N	158.5	61.7	61.5	61.1	60.8	60.9	61.2	61.4	61.7	61.9	61.8	61.7
15	18.7 N	156.1	61.0	60.7	60.5	60.4	60.5	60.7	60.7	61.1	61.3	61.3	61.1
16	17.5 N	153.4	60.7	60.6	60.3	60.3	60.3	60.7	60.7	60.9	61.1	61.4	61.1
17	16.1 N	150.9	60.7	60.6	60.5	60.1	60.2	60.5	60.7	60.9	61.1	61.0	61.0
18	14.9 N	148.3	60.7	60.5	60.2	59.9	60.0	60.4	60.6	60.9	61.0	61.0	60.9
19	14.0 N	146.0	60.8	60.3	59.9	59.7	59.5	59.6	59.9	60.5	60.7	60.7	60.7
20	13.6 N	144.6	59.7	59.4	59.2	58.8	58.7	58.6	58.6	58.7	58.9	58.9	59.0
26	16.1 N	144.2	58.9	58.7	58.4	58.2	58.1	58.1	58.5	58.7	58.9	59.0	59.0
27	18.6 N	144.0	59.7	59.6	59.5	59.5	59.5	59.6	60.0	60.5	60.5	60.6	60.5
28	21.5 N	144.2	61.1	61.0	60.9	60.9	60.9	61.1	61.2	61.2	61.2	61.2	60.9
29	23.4 N	144.2	61.7	61.1	61.1	61.1	61.2	61.2	61.4	61.2	61.3	61.2	61.1
30	25.3 N	144.1	61.5	61.5	61.0	60.8	61.0	61.0	61.1	61.2	61.4	61.5	61.5
31	26.4 N	144.4	60.9	60.5	60.4	60.4	60.4	60.4	60.5	60.9	60.9	60.9	60.9
June 1	28.5 N	144.0	59.8	59.6	59.4	59.3	59.3	59.1	59.2	59.2	59.2	58.9	58.3
2	30.2 N	143.9	54.4	54.4	54.5	54.7	55.4	55.7	56.2	56.5	56.6	56.9	57.2
3	31.1 N	144.3	58.8	58.5	58.6	58.6	58.7	58.8	58.9	59 3	59.5	59.4	59.3
4	32.7 N	142.3	57.7	57.3	57.0	56.2	56.1	55.9	56.2	56.2	56.1	56.1	55.9
5	34.0 N	141.2	56.6	56.5	56.3	56.2	56.1	56.3	56.6	56.7	56.8	57.1	57.4
6	34.9 N	140.2	55.0	54.3	53.4	52.7	52.4	51.0	50.4	48.9	48.4	47.4	46.4
7	34.9 N	139.9	51.6	52.5	53.0	53.9	54.1	54.4	55.0	55.0	55.4	55.9	56.0
25	34.7 N	141.0	61.4	60.9	60.8	60.7	61.2	61.4	61.4	61.7	61.9	61.9	62.0
26	36.0 N	142.1	63.6	63.6	63.7	63.8	64.0	64.3	64.0	64.1	64.3	64.3	64.4
27	36.7 N	143.6	64.4	64.3	64.2	64.0	63.9	63.9	64.3	64.4	64.4	64.3	64.3
28	36.8 N	145.4	63.7	63.6	63.5	63.4	63.3	63.3	63.5	63.6	63.7	63.7	63.8
29	37.8 N	145.5	64.8	64.7	64.6	64.5	64.5	64.5	64.6	64.8	64.9	64.9	65.0
30	38.1 N	147.1	64.6	64.4	64.6	64.4	64.6	64.8	64.9	65.1	65.3	65.6	65.6
July 1	38.7 N	147.7	66.5	66.5	66.4	66.4	66.5	66.6	66.8	66.8	66.8	69.9	69.9
2	39.8 N	149.5	65.8	65.6	65.6	65.5	65.4	65.6	65.6	65.6	65.6	65.5	65.3
3	40.4 N	151.1	64.3	64.3	64.2	64.2	64.2	64.3	64.2	64.4	64.3	64.2	64.2
4	41.3 N	153.1	63.8	63.7	63.7	63.6	63.7	63.8	63.8	63.6	63.6	63.5	63.4
5	42.6 N	155.6	63.3	63.2	63.2	62.7	62.5	62.6	62.9	63.1	63.1	63.3	63.3
6	43.8 N	158.3	63.0	63.0	62.9	62.9	63.0	63.3	63.4	63.4	62.8	62.6	62.6
7	45.4 N	159.6	61.5	61.5	61.5	61.5	61.5	61.5	61.5	61.5	61.4	60.7	60.6
8	46.9 N	163.0	56.0	55.5	55.3	55.1	55.2	55.2	55.1	55.0	54.8	54.4	54.3
9	47.0 N	166.6	53.3	53.0	52.8	52.8	52.9	53.1	52.9	53.1	52.7	52.4	52.3
10	46.7 N	169.5	53.0	53.4	53.7	54.1	54.1	54.2	54.8	55.2	55.3	55.0	55.5
11	46.0 N	171.7	59.3	59.5	59.7	60.4	60.6	60.7	61.2	61.6	61.6	61.6	62.1
12	45.3 N	173.1	65.4	65.4	65.6	65.7	65.8	66.2	66.2	66.5	66.7	66.9	66.7
13	46.2 N	174.1	67.0	66.9	66.3	66.0	65.5	65.6	65.5	65.5	65.5	65.3	65.4
14	48.1 N	178.1	65.2	65.1	65.0	65.2	65.1	65.1	65.1	65.2	64.7	64.6	64.5
14	49.2 N	183.3	63.1	63.1	63.0	63.0	63.0	63.1	63.2	63.3	63.3	63.4	63.7
15	50.5 N	187.2	64.6	64.5	64.5	64.4	64.4	65.0	65.1	65.2	65.4	65.3	65.1
16	51.4 N	192.7	68.7	69.0	69.0	68.9	69.0	69.3	69.8	70.0	69.9	69.8	69.8
17	52.4 N	198.2	70.0	70.0	70.0	70.1	70.1	70.1	70.1	70.1	69.9	69.8	69.7
18	52.6 N	204.4	69.7	69.7	69.7	69.7	69.6	69.5	69.5	69.3	68.8	68.5	68.4
19	52.0 N	209.6	67.0	66.9	66.4	66.3	66.1	65.8	65.7	65.4	65.1	64.3	64.0
20	50.2 N	213.9	62.1	62.0	61.9	61.9	61.8	61.7	61.6	61.2	61.0	60.9	60.6
21	48.0 N	217.3	59.5	59.6	59.6	59.5	59.4	59.5	59.7	59.8	59.9	59.9	59.9
22	46.0 N	220.3	62.0	61.9	61.9	61.9	62.0	62.0	62.1	62.2	62.1	62.1	62.2
23	44.3 N	222.4	63.0	62.9	63.0	63.0	63.1	63.4	63.4	63.7	63.8	64.0	64.1
24	42.6 N	224.8	65.6	65.9	66.0	66.1	66.1	66.3	66.4	66.7	66.8	66.9	67.1
25	40.7 N	227.7	65.6	65.5	65.4	65.3	65.4	65.5	65.6	65.9	66.0	66.0	66.2
26	39.6 N	230.5	66.5	66.4	66.4	66.4	66.4	66.5	67.0	67.2	67.2	67.3	67.3
27	38.8 N	234.3	65.5	65.2	64.6	64.4	64.0	63.7	63.5	63.5	63.5	63.2	63.2
28	38.2 N	237.2	61.9	61.8	61.6	61.6	61.7	61.9	62.1	62.3	62.5	62.6	63.0

pressure, Carnegie, 1928-29--Continued

mean hour, 700 + tabular value													Mean
11	12	13	14	15	16	17	18	19	20	21	22	23	
													mm
57.9	57.5	56.9	56.5	56.1	56.1	56.3	56.5	56.8	57.3	57.7	58.0	58.1	757.25
57.6	57.2	56.6	56.3	55.8	55.8	56.0	56.6	57.1	57.5	57.7	57.7	57.8	756.98
57.4	56.9	56.4	55.7	55.5	55.6	55.7	56.2	56.6	57.1	57.2	57.4	57.4	756.75
57.8	57.2	56.7	56.0	55.9	55.9	56.1	56.4	57.0	57.8	58.0	58.3	58.3	757.15
58.1	57.8	57.0	56.5	55.9	56.2	56.6	57.4	57.7	57.8	58.0	58.2	58.3	757.52
58.2	57.7	57.4	57.0	56.9	56.5	56.6	57.3	57.8	58.3	58.5	58.5	58.4	757.40
59.0	58.5	58.1	57.5	57.4	57.2	57.2	57.6	58.3	58.5	59.1	59.3	59.3	758.10
59.4	59.0	58.2	57.5	57.3	57.3	57.6	57.9	57.9	58.3	58.6	59.4	59.3	758.45
60.2	59.4	59.2	58.8	58.5	58.4	58.6	59.2	59.4	59.8	60.3	60.4	60.4	758.89
60.6	59.9	59.6	59.1	59.0	58.7	59.2	59.4	59.7	60.0	60.4	60.4	60.2	759.92
59.9	59.6	59.2	58.6	58.4	58.3	58.4	58.6	59.4	59.7	60.2	60.3	60.2	759.46
60.6	60.3	59.6	59.5	59.4	59.4	59.7	60.2	60.4	60.8	61.2	61.2	61.2	760.21
61.4	60.9	60.4	60.2	60.0	59.9	60.1	60.3	60.4	60.6	60.9	61.3	61.3	760.67
62.6	62.4	61.8	61.6	61.0	60.9	60.9	61.0	61.2	61.6	61.8	62.3	62.4	761.67
62.5	62.1	61.8	61.5	61.4	61.3	60.9	61.0	61.5	61.7	62.0	62.0	61.9	761.89
61.3	60.7	60.6	60.2	59.7	59.8	59.8	60.2	60.6	60.9	61.5	61.6	61.6	761.01
60.7	60.5	59.9	59.6	59.5	59.5	59.6	59.8	59.9	60.5	60.8	60.9	60.8	760.47
61.0	60.7	60.3	59.7	59.6	59.5	59.6	59.9	60.5	60.7	60.7	60.9	60.9	760.50
60.8	60.5	59.9	59.7	59.6	59.6	59.6	59.7	60.0	60.6	60.9	61.1	61.5	760.45
60.8	60.7	60.3	59.7	59.4	59.2	59.4	59.7	60.3	60.7	60.8	60.9	61.0	760.38
60.4	59.7	58.9	58.5	58.4	57.9	58.0	58.5	58.7	59.5	59.6	59.9	60.0	759.60
59.1	58.9	58.7	58.2	57.8	57.6	57.6	57.6	57.7	57.8	58.2	58.3	58.4	758.52
59.0	58.6	58.4	57.9	57.7	57.7	57.9	58.5	58.7	59.3	59.7	60.0	60.1	758.67
60.2	59.7	59.4	59.2	59.0	59.0	59.2	59.5	59.8	60.4	60.5	60.9	61.1	759.89
60.7	60.5	60.1	59.9	59.9	59.9	59.9	60.2	60.8	61.1	61.7	61.9	61.8	760.83
60.9	60.7	60.4	60.0	60.0	59.9	60.3	60.5	60.9	61.5	61.9	61.9	61.7	761.01
61.1	61.0	60.8	60.2	60.1	60.0	60.0	60.1	60.5	60.7	61.0	61.1	61.1	760.88
60.7	60.4	60.3	60.1	60.0	59.8	59.8	60.0	60.1	60.3	60.3	60.3	60.0	760.38
58.2	57.9	57.6	57.3	56.9	56.4	56.0	55.5	54.9	54.8	54.7	54.9	54.6	757.54
57.5	57.6	57.4	57.4	57.6	57.8	57.9	57.9	58.3	58.8	59.2	59.0	59.0	757.00
59.0	58.8	58.1	57.9	57.6	57.4	57.2	57.4	57.6	57.8	58.0	57.9	57.8	758.37
55.6	55.5	55.3	55.2	55.0	54.9	54.7	54.9	55.3	55.6	55.8	56.7	56.8	755.92
56.9	56.7	56.5	56.3	55.8	55.7	55.5	55.6	55.7	56.0	56.2	56.3	55.6	756.31
44.9	44.9	45.0	45.3	46.6	46.6	47.0	47.4	48.7	49.3	50.3	50.8	51.2	749.10
56.1	56.0	55.8	56.1	56.2	56.3	56.4	56.8	57.2	56.7	58.4	59.0	59.1	755.70
62.0	62.0	61.6	61.6	61.6	61.7	61.7	61.8	62.3	62.6	63.3	63.6	63.6	761.86
64.3	64.2	64.3	64.1	64.0	63.8	63.6	63.6	63.7	63.8	64.1	64.3	64.4	764.01
64.2	64.1	63.8	63.7	63.6	63.6	63.4	63.4	63.6	63.6	63.8	63.9	63.8	763.95
63.9	63.9	63.9	63.8	63.8	63.7	63.6	63.6	63.8	63.9	64.3	64.5	64.6	763.77
64.9	64.8	64.6	64.5	64.4	64.4	64.4	64.5	64.6	64.6	64.8	64.8	64.7	764.66
65.6	65.5	65.4	65.4	65.4	65.4	65.5	65.7	65.9	66.1	66.4	66.5	66.6	765.39
66.8	66.7	66.6	66.5	66.5	66.4	66.4	66.5	66.5	66.4	66.4	66.3	66.2	766.80
65.4	65.3	64.9	64.7	64.5	64.2	64.0	64.0	64.0	64.2	64.4	64.4	64.4	764.98
64.4	64.4	64.4	64.2	64.0	63.8	63.6	63.7	63.6	63.8	64.2	64.2	64.2	764.14
63.5	63.4	63.3	63.2	62.9	62.9	63.0	63.1	63.1	63.3	63.3	63.3	63.2	763.40
63.4	63.3	63.1	63.0	62.6	62.4	62.4	62.5	62.8	62.9	63.0	62.9	63.0	762.94
62.4	62.4	62.2	61.9	61.5	61.4	61.4	61.4	61.4	61.6	61.4	61.4	61.4	762.28
60.2	59.7	59.2	58.2	57.9	57.4	57.1	57.0	56.2	56.2	56.4	56.2	56.2	759.28
54.2	54.1	53.9	53.7	53.7	53.6	53.5	53.6	53.5	53.6	53.8	53.8	53.4	754.35
52.1	52.1	52.0	51.9	51.8	51.8	51.8	51.9	52.0	52.2	52.7	52.9	52.9	752.46
56.1	56.3	56.4	56.4	57.0	57.0	57.0	57.3	57.6	58.1	58.4	58.9	58.9	756.00
62.5	62.7	62.7	62.7	62.6	63.2	63.6	63.7	64.1	64.4	65.1	65.2	65.3	762.34
66.8	66.9	66.8	66.7	66.8	66.8	66.5	66.5	66.6	66.9	67.2	67.2	67.1	766.50
65.5	65.3	65.2	64.9	64.9	64.7	64.7	64.7	64.4	64.5	65.0	64.8	65.1	765.34
64.3	64.2	63.6	63.6	63.6	63.5	63.3	63.3	63.2	63.2	63.3	63.4	63.2	764.19
63.6	63.7	63.7	63.8	63.8	63.9	63.9	64.0	64.0	64.1	64.5	64.6	64.8	763.65
65.2	65.4	65.6	65.8	66.3	66.4	66.6	66.7	67.0	67.6	67.9	68.2	68.7	765.87
69.7	69.6	69.5	69.4	69.4	69.3	69.3	69.2	69.2	69.4	69.9	69.9	70.0	769.46
69.7	69.7	69.7	69.7	69.4	69.3	69.1	69.3	69.1	69.3	69.6	69.7	69.8	769.72
68.6	68.4	68.4	68.3	68.2	68.0	67.7	67.7	67.7	67.4	67.4	67.3	67.2	768.53
64.0	64.0	63.8	63.3	63.2	63.2	63.0	62.8	62.7	62.6	62.7	62.2	62.2	764.28
60.7	60.7	60.5	60.2	60.2	60.1	59.9	59.9	59.7	59.8	59.8	59.7	59.9	760.74
60.1	60.3	60.3	60.4	60.6	60.6	60.6	60.6	60.8	60.9	61.0	61.1	61.4	760.21
62.2	62.2	62.4	62.3	62.2	62.3	62.4	62.3	62.2	62.3	62.6	62.8	63.0	762.23
64.2	64.2	64.3	64.3	64.4	64.3	64.2	64.4	64.5	64.9	65.2	65.3	65.5	764.04
67.1	67.0	67.0	67.0	66.6	66.4	66.2	66.2	66.0	66.1	66.1	65.8	65.6	766.38
66.3	66.2	66.2	66.2	66.2	66.1	66.1	66.0	66.2	66.3	66.5	66.5	66.5	765.99
67.4	67.4	67.2	67.1	67.0	66.7	66.4	66.2	66.0	66.0	66.2	66.0	65.8	766.67
63.2	63.2	62.8	62.5	62.2	62.0	61.8	61.4	61.5	61.6	62.0	62.0	62.0	763.02
63.1	63.1	63.0	62.8	62.3	61.7	61.5	61.4	61.4	61.5	61.7	61.9	62.0	762.10

Table 77. Hourly values of atmospheric

Date	Latitude	Longitude east	Values in mm at local 00	01	02	03	04	05	06	07	08	09	10
1929	°	°											
Sep. 4	37.0 N	236.3	59.5	59.6	59.5	59.6	59.6	59.9	60.2	60.6	60.9	61.1	61.6
5	35.5 N	235.0	60.8	60.8	60.6	60.6	60.6	60.7	60.9	61.0	61.2	61.6	61.7
6	33.8 N	233.7	61.5	61.3	61.2	61.1	60.9	60.9	61.0	61.4	61.6	61.6	61.7
7	32.4 N	232.1	61.0	60.9	60.8	60.7	60.7	60.7	60.8	60.9	61.0	61.0	61.0
8	31.6 N	231.2	61.0	60.8	60.7	60.6	60.5	60.7	60.9	61.3	61.5	61.6	61.7
9	30.4 N	229.0	61.8	61.8	61.8	61.7	61.8	62.1	62.3	62.8	62.9	63.1	63.3
10	29.3 N	227.4	62.9	62.9	62.9	62.7	62.6	62.7	62.8	63.0	63.0	63.2	63.1
11	28.2 N	225.7	62.2	62.0	61.6	61.6	61.5	61.5	61.6	61.7	61.8	62.0	62.0
12	27.7 N	224.6	61.6	61.2	61.0	61.0	61.0	61.1	61.3	61.5	61.8	62.1	62.1
13	27.0 N	222.3	62.4	62.3	62.1	62.0	62.1	62.3	62.7	62.9	63.0	63.2	63.2
14	26.7 N	220.9	62.8	62.6	62.3	62.2	62.0	62.2	62.3	62.6	62.8	63.0	63.0
15	26.5 N	219.4	62.6	62.4	62.1	61.8	61.6	61.6	61.6	61.9	62.1	62.3	62.6
16	26.2 N	217.9	63.1	63.0	62.6	62.5	62.4	62.4	62.5	62.6	62.8	63.1	63.3
17	25.1 N	216.4	63.9	64.0	63.7	63.6	63.7	63.8	64.2	64.2	64.6	64.9	65.0
18	24.0 N	214.4	64.8	64.6	64.1	64.0	64.1	64.2	64.2	64.6	64.6	64.6	64.6
19	23.4 N	211.3	63.6	63.0	62.8	62.6	62.5	62.6	62.6	62.8	63.0	63.0	63.0
20	22.9 N	208.6	61.9	61.4	61.0	60.8	60.7	60.6	60.8	61.2	61.5	61.6	61.7
21	22.3 N	206.4	61.6	61.3	61.1	61.0	61.0	61.1	61.3	61.7	61.8	62.0	62.0
22	21.7 N	204.3	61.9	61.6	61.5	61.3	61.0	61.1	61.1	61.2	61.5	61.7	61.8
Oct. 3	23.5 N	200.4	62.8	62.6	62.5	62.3	62.2	62.3	62.6	62.9	63.2	63.6	63.7
4	26.4 N	199.5	63.5	63.0	62.8	62.8	62.7	62.8	62.9	63.0	63.7	63.8	63.8
5	29.1 N	198.8	63.9	63.8	63.5	63.3	63.2	63.3	63.7	64.0	64.3	64.8	64.8
6	31.7 N	199.0	66.0	66.0	66.0	66.0	66.0	66.0	66.4	66.8	67.1	67.4	67.8
7	32.8 N	199.3	69.1	69.0	68.6	68.2	68.4	68.4	68.6	69.1	69.4	69.6	69.5
8	34.3 N	200.0	68.1	68.0	67.4	67.0	66.8	66.7	66.6	66.4	66.4	66.4	66.2
9	34.1 N	203.1	61.9	60.9	60.5	59.9	59.9	59.9	59.9	59.8	60.1	59.9	60.0
15	31.8 N	219.3	58.1	57.9	57.6	57.3	57.5	57.9	58.1	58.8	59.1	59.2	59.1
16	29.1 N	220.8	62.3	62.3	62.1	62.2	62.4	62.6	62.9	63.3	63.6	63.7	63.9
17	27.4 N	221.9	63.2	63.1	62.9	62.8	62.9	63.0	63.1	63.3	63.9	64.0	63.9
18	26.0 N	222.9	63.2	63.1	62.9	62.8	62.8	63.0	63.1	63.3	63.9	63.9	63.9
19	25.0 N	222.2	62.9	62.7	62.4	62.2	62.1	62.3	62.3	62.7	63.1	63.2	63.2
20	23.2 N	221.7	61.8	61.4	61.1	60.9	60.8	60.8	60.9	61.0	61.2	61.7	61.5
21	21.2 N	221.5	61.2	61.2	61.0	60.6	60.6	60.7	61.0	61.5	61.8	62.0	61.5
22	18.3 N	222.0	61.5	61.1	60.6	60.5	60.1	60.3	60.5	60.6	60.9	61.0	60.6
23	16.2 N	223.0	59.8	59.5	59.3	59.3	59.2	59.3	59.5	59.7	59.8	60.0	59.9
24	13.6 N	223.5	59.3	58.7	58.3	58.0	57.8	58.3	58.5	58.5	58.6	58.9	58.8
25	12.7 N	222.5	58.5	57.5	57.7	58.2	58.2	58.4	58.7	59.3	60.0	60.3	60.2
26	11.3 N	221.3	59.5	59.2	58.8	58.7	58.6	58.8	59.3	59.8	60.0	60.3	59.9
27	10.1 N	220.3	60.0	59.6	59.4	59.5	59.7	59.8	60.5	61.2	61.6	61.9	61.6
28	8.6 N	219.2	61.0	60.5	60.3	59.9	60.1	60.5	60.7	61.5	61.9	61.9	61.7
29	7.7 N	218.6	59.7	59.0	58.7	58.0	58.0	58.2	58.5	59.0	59.1	59.1	58.9
30	7.1 N	217.4	57.2	56.6	56.2	56.2	56.3	56.4	57.1	57.5	57.8	57.9	58.0
31	6.7 N	216.6	57.2	56.2	55.4	55.2	55.4	55.7	56.3	56.8	57.1	57.2	57.1
Nov. 1	5.8 N	215.3	55.4	54.8	54.4	54.4	54.3	54.5	55.0	55.6	56.2	56.3	56.3
2	4.9 N	213.2	55.2	55.1	54.6	54.4	54.5	54.8	55.2	55.4	56.2	56.2	56.2
3	4.3 N	210.7	56.2	55.7	55.4	55.5	55.5	55.6	55.8	56.0	56.4	57.0	57.4
4	3.0 N	210.2	56.6	56.2	56.0	55.9	55.9	56.3	56.7	57.1	57.4	57.5	57.4
5	0.8 N	208.5	56.5	55.9	55.5	55.3	55.3	55.5	55.7	56.3	57.0	57.3	57.1
6	1.8 S	207.6	55.9	55.3	55.1	55.1	55.1	55.4	55.5	56.3	56.6	56.5	56.3
7	4.9 S	206.6	55.4	55.2	55.0	55.0	55.2	55.5	56.1	56.3	56.5	56.5	56.3
8	6.6 N	204.9	56.3	56.0	55.5	55.5	55.6	56.1	56.3	56.7	57.1	57.1	57.0
9	8.1 S	203.1	55.7	55.3	55.1	55.1	55.3	55.4	56.1	56.3	56.6	56.5	56.3
10	9.0 S	201.9	55.2	54.5	54.3	54.3	54.4	55.0	55.5	56.0	56.1	55.7	55.6
11	9.4 S	200.9	55.7	55.3	54.7	54.6	54.9	55.3	56.2	56.4	56.5	56.6	56.5
12	10.3 S	198.9	56.3	56.0	55.7	55.6	55.8	56.6	56.9	57.6	57.8	57.8	57.6
13	11.0 S	198.0	58.0	57.4	57.1	57.1	57.1	57.5	58.0	58.7	58.8	58.7	58.5
14	11.6 S	196.6	57.4	56.8	56.6	56.5	56.7	56.8	57.1	57.7	57.8	57.8	57.8
15	12.1 S	195.0	56.1	55.8	55.6	55.4	55.7	55.9	56.0	56.5	56.7	56.7	56.7
16	12.8 S	193.0	56.2	55.6	55.4	55.2	55.0	55.3	55.6	56.0	56.3	56.3	56.2
17	13.6 S	191.6	55.6	55.4	54.8	54.6	54.9	55.2	55.4	55.9	56.1	56.1	56.1

pressure, Carnegie, 1928-29--Concluded

mean hour, 700 + tabular value													Mean
11	12	13	14	15	16	17	18	19	20	21	22	23	
61.6	61.6	61.6	61.5	61.3	61.0	60.8	60.6	60.6	60.6	60.8	60.7	60.8	760.65
61.8	61.6	61.6	61.4	61.2	61.0	60.9	60.8	60.7	60.9	61.3	61.4	61.5	761.11
61.6	61.4	61.2	61.0	60.8	60.7	60.6	60.4	60.4	60.7	61.0	61.0	60.9	761.08
61.1	61.1	60.8	60.7	60.6	60.4	60.4	60.4	60.5	60.9	61.2	61.0	61.0	760.82
61.6	61.4	61.2	60.8	60.7	60.5	60.5	60.6	60.9	61.3	61.7	61.7	61.7	761.08
63.2	63.0	62.8	62.6	62.1	62.1	62.0	62.0	62.4	62.9	63.0	63.0	62.9	762.48
63.0	62.8	62.5	62.0	61.7	61.6	61.5	61.4	61.7	61.9	62.3	62.4	62.4	762.46
61.9	61.6	61.5	61.0	60.9	60.8	60.8	60.8	61.1	61.6	61.8	61.8	61.8	761.54
62.0	61.9	61.6	61.4	61.1	61.1	61.2	61.3	61.6	62.0	62.3	62.4	62.5	761.59
63.1	62.8	62.6	62.1	61.8	61.8	61.8	61.8	62.0	62.6	62.8	62.9	62.9	762.47
62.8	62.6	62.0	61.8	61.7	61.5	61.5	61.6	61.8	62.1	62.6	62.6	62.6	762.29
62.5	62.3	62.0	61.8	61.6	61.4	61.3	62.6	62.8	63.6	63.8	63.9	64.0	762.95
63.4	63.2	62.8	62.7	62.6	62.5	62.5	62.6	62.8	63.6	63.8	63.9	64.0	762.95
64.9	64.6	63.9	63.8	63.8	63.6	63.7	63.9	64.2	64.8	65.0	65.1	65.0	764.24
64.4	63.8	63.0	62.8	62.6	62.6	62.6	62.8	63.0	63.2	63.8	63.8	63.8	763.78
63.0	62.6	61.8	61.3	60.6	60.8	60.8	61.0	61.5	61.8	62.0	62.1	62.0	762.20
61.5	61.2	60.6	60.1	59.9	59.9	60.0	60.2	60.5	61.2	61.5	61.6	61.6	760.96
61.9	61.6	61.0	60.6	60.5	60.5	60.6	60.8	61.4	61.8	62.1	62.1	62.0	761.37
61.7	61.5	60.8	60.6	60.4	60.1	60.1	60.2	60.7	61.0	61.5	61.7	61.6	761.15
63.7	63.3	63.1	62.6	62.4	62.4	62.6	62.8	63.0	63.7	63.8	63.8	63.7	762.98
63.8	63.7	63.2	62.8	62.7	62.8	63.0	63.2	63.5	63.8	64.0	64.0	64.0	763.30
64.7	64.4	64.3	63.9	63.8	63.9	64.0	64.2	64.4	65.0	65.8	66.0	66.0	764.29
67.8	67.7	67.3	67.0	67.0	67.1	67.2	67.6	67.9	68.3	68.4	68.8	68.9	767.19
69.4	69.1	68.7	68.3	68.2	68.0	68.3	68.5	68.9	68.8	68.7	68.6	68.4	768.74
65.7	65.2	64.4	63.6	63.1	62.8	62.5	62.4	62.4	62.3	62.1	62.1	61.9	764.85
59.9	59.5	59.3	59.2	59.2	59.3	59.7	60.1	60.7	60.9	61.5	62.0	62.1	760.25
59.6	59.9	59.5	59.3	59.7	59.9	60.3	60.7	61.1	61.9	62.2	62.3	62.3	758.84
63.7	63.3	62.9	62.7	62.6	62.3	62.5	62.9	63.1	63.3	63.4	63.5	63.4	762.95
63.8	63.1	62.8	62.4	62.3	62.1	62.1	62.3	62.8	63.0	63.1	63.3	63.3	763.02
63.8	63.1	62.7	62.3	62.1	62.1	62.3	62.5	62.7	62.9	63.1	63.2	63.0	762.99
62.8	62.3	61.8	61.4	61.2	61.0	61.0	61.2	61.4	61.5	61.8	62.0	62.0	762.10
61.3	60.9	60.4	60.1	60.1	60.1	60.3	60.5	60.9	61.5	61.8	61.9	61.7	761.02
61.3	61.1	60.9	60.5	60.5	60.5	60.5	60.8	61.0	61.5	61.5	61.6	61.6	761.10
60.3	59.7	59.3	59.0	58.8	58.8	59.2	59.4	59.6	59.7	59.9	60.0	59.9	760.05
59.7	59.1	58.5	58.1	57.9	57.9	58.2	58.3	58.8	59.3	59.5	59.5	59.3	759.14
58.3	57.5	56.5	57.0	56.9	56.8	57.4	57.5	58.0	58.4	58.6	58.7	58.5	758.08
59.5	59.3	59.2	58.5	58.2	58.5	58.7	58.7	59.3	59.5	59.7	59.9	59.9	759.00
59.5	58.7	58.5	58.3	58.2	58.5	58.9	59.3	59.7	60.0	60.3	60.3	60.3	759.31
61.2	60.5	60.0	59.4	59.3	59.5	59.7	60.3	60.8	61.3	61.5	61.5	61.5	760.47
60.7	60.0	59.7	59.1	59.1	59.1	59.7	59.9	60.1	60.6	60.7	60.6	60.4	760.40
58.0	57.3	56.8	56.1	56.0	56.1	56.5	57.0	57.4	58.0	58.0	58.0	57.9	757.89
57.4	57.2	56.2	56.0	55.4	55.3	55.4	55.7	56.6	57.2	57.4	57.4	57.2	756.73
56.4	65.2	55.2	54.5	54.3	54.4	54.7	55.2	55.4	55.9	56.0	56.0	56.0	755.82
55.7	55.2	54.3	54.0	53.9	53.7	53.8	54.1	54.4	54.6	55.2	55.3	55.3	754.86
55.8	54.7	54.0	53.8	53.9	54.1	54.4	54.9	55.0	55.4	56.1	56.2	56.2	755.10
57.3	56.6	56.0	55.3	54.7	54.8	55.2	56.0	56.2	56.6	57.0	57.0	56.9	756.08
57.3	56.6	56.3	56.0	55.5	55.3	55.5	55.6	56.1	56.3	56.7	57.0	57.0	756.42
56.6	55.8	55.1	54.9	54.5	54.5	54.7	55.3	55.6	56.0	56.2	56.3	56.2	755.80
55.7	55.3	54.7	54.1	54.1	54.3	54.5	55.1	55.5	56.0	56.1	56.1	55.8	755.43
56.1	55.6	55.5	55.5	55.5	55.6	55.8	56.3	56.5	57.1	57.1	57.1	56.8	755.98
56.3	56.0	55.3	54.8	54.5	54.5	54.9	55.3	55.5	55.8	56.3	56.3	56.3	755.88
55.5	55.3	54.5	54.3	54.1	54.0	54.3	55.0	55.2	55.5	55.6	55.6	55.4	755.33
55.5	55.4	55.2	54.9	54.5	54.5	54.6	55.1	55.3	55.5	55.6	56.1	56.1	755.20
56.0	55.5	55.0	54.7	54.7	54.8	55.4	55.7	56.3	56.6	56.7	56.6	56.4	755.71
57.3	56.8	56.4	56.1	56.1	56.2	56.5	57.1	57.5	57.9	58.4	58.5	58.5	756.96
58.4	57.7	57.0	56.8	56.6	56.5	56.6	56.8	57.3	57.8	57.8	57.8	57.8	757.58
57.6	57.4	56.8	56.2	56.0	56.0	56.0	56.1	56.6	56.8	56.7	56.8	56.6	756.86
56.3	55.7	55.0	54.7	54.5	54.1	54.4	54.6	54.9	55.5	55.7	56.3	56.4	755.63
55.9	55.5	55.1	54.5	54.3	54.3	54.4	54.6	55.2	55.6	56.1	56.1	56.1	755.45
56.0	55.6	55.0	54.4	54.0	53.9	53.9	54.0	54.3	54.6	54.9	55.2	55.1	755.04

Table 78. Hourly values of air

From dry-bulb readings, Negretti-Zambra thermograph,

Date	Latitude	Longitude east	Values in °C,										
			00	01	02	03	04	05	06	07	08	09	10
1928	°	°											
July 29	60.7 N	328.8	10.6	10.4	10.1	9.0	9.0	9.3	9.3	9.6	10.0	10.0	10.1
30	59.3 N	325.8	9.1	9.0	8.9	8.9	8.9	8.6	8.4	8.4	8.5	9.0	9.2
31	57.9 N	325.6	10.0	9.9	9.7	9.6	9.6	9.4	9.5	9.7	9.8	10.0	11.3
Aug. 1	58.3 N	324.2	10.8	10.9	10.9	10.9	10.9	10.5	10.2	10.1	10.0	10.0	10.6
2	58.3 N	321.3	8.6	8.6	8.6	9.2	9.6	10.4	10.6	10.6	10.9	11.2	11.7
3	57.9 N	314.5	9.7	9.6	9.6	9.6	9.5	9.5	9.4	9.4	9.5	9.7	10.2
4	54.5 N	311.0	9.5	9.1	9.5	9.6	9.7	9.6	9.5	9.8	9.6	9.7	10.1
5	51.6 N	310.4	9.6	9.9	9.7	9.7	9.6	9.5	9.4	9.4	8.9	9.7	9.8
6	48.4 N	311.8	8.5	8.9	8.9	9.0	9.1	8.8	8.8	9.0	9.4	9.7	10.6
7	45.9 N	312.1	11.9	12.2	12.3	12.4	12.4	12.4	12.5	12.6	12.4	12.4	12.7
8	43.2 N	313.0	15.5	15.5	15.5	15.4	15.3	15.2	15.2	15.2	15.2	15.2	15.3
9	42.2 N	312.7	16.8	16.7	16.6	16.6	16.7	16.8	17.2	17.3	17.5	19.8	19.5
10	39.8 N	311.1	20.6	20.6	20.9	21.2	21.3	21.8	20.6	21.1	21.9	21.7	23.1
11	38.6 N	311.2	24.1	23.9	24.1	24.2	24.7	24.9	25.0	25.0	24.9	25.6	25.4
12	37.0 N	311.6	25.2	25.1	25.1	25.1	25.0	25.0	25.1	25.6	26.1	26.0	26.5
13	36.8 N	313.4	25.7	25.6	25.3	24.8	25.0	25.1	25.2	25.3	25.0	25.2	26.0
14	35.2 N	315.6	26.0	26.0	26.0	26.0	26.0	26.0	26.1	26.2	26.2	26.4	26.3
15	33.6 N	317.7	26.4	26.2	26.1	26.1	26.1	26.1	26.2	26.2	26.2	26.6	27.0
16	31.2 N	318.8	26.4	26.4	26.4	26.6	26.5	26.6	26.0	26.6	27.0	27.0	27.1
17	29.8 N	319.4	26.7	26.3	26.3	26.4	26.6	26.1	25.7	26.1	27.4	26.7	27.0
18	27.9 N	320.5	26.2	26.2	26.2	26.2	26.1	26.0	26.1	26.4	26.8	26.2	26.8
19	25.7 N	321.0	26.0	26.1	26.1	26.1	26.1	26.2	26.1	24.7	25.5	25.8	26.7
20	24.0 N	320.4	26.2	26.1	26.0	25.9	25.8	25.7	25.7	25.3	24.2	25.1	26.4
21	21.8 N	320.4	25.2	25.3	25.8	26.1	26.1	26.1	26.1	26.2	26.4	26.3	27.2
22	19.2 N	321.5	26.0	25.9	26.0	25.8	25.6	25.6	25.3	25.3	26.1	26.4	26.1
23	16.6 N	322.2	25.5	25.8	25.8	25.6	25.5	25.6	25.6	25.8	26.3	26.5	27.4
24	15.8 N	322.1	26.0	25.9	25.7	25.6	25.6	25.4	25.5	26.4	27.2	27.6	28.4
25	14.9 N	321.8	26.6	26.5	25.9	26.3	26.3	26.1	26.2	26.5	27.1	27.2	28.0
26	13.9 N	322.0	26.2	25.3	25.4	26.1	25.7	25.9	25.3	26.0	26.2	27.3	28.3
27	13.4 N	322.0	26.2	26.3	26.3	26.3	26.4	26.1	25.8	25.6	26.3	26.3	27.3
28	11.9 N	322.2	27.0	27.0	27.0	26.9	26.8	26.8	26.6	27.1	27.7	27.8	27.8
29	10.8 N	322.6	25.5	25.7	25.3	25.2	25.6	26.1	25.8	25.6	26.1	26.5	27.4
30	9.5 N	322.8	26.3	26.3	26.2	26.3	26.1	26.1	26.1	26.3	26.8	27.4	28.1
31	8.2 N	323.8	24.5	25.1	25.3	25.5	25.2	25.8	26.0	26.2	26.3	26.9	27.3
Sep. 1	9.4 N	323.3	25.2	25.3	25.4	25.3	24.7	25.0	25.1	25.3	25.6	25.8	26.3
2	9.8 N	323.3	25.3	25.4	25.7	26.0	26.1	26.1	26.2	26.3	26.8	27.1	28.1
3	11.2 N	322.9	26.1	26.2	25.3	25.6	26.1	26.0	26.1	26.6	27.0	27.3	27.8
4	11.4 N	322.0	26.1	26.1	25.8	26.0	26.1	25.5	27.0	27.3	28.1	28.5	29.3
5	11.6 N	319.2	27.3	27.3	27.2	27.2	27.2	27.2	27.3	27.5	27.8	28.1	28.5
6	11.7 N	317.4	27.2	27.2	27.2	27.1	27.1	27.1	27.1	27.3	27.6	28.1	29.2
7	11.3 N	315.8	26.5	26.5	26.5	25.5	26.5	26.3	26.7	27.3	27.5	28.1	29.1
8	11.6 N	314.9	27.1	27.0	26.7	26.7	26.5	26.6	26.6	26.3	29.2	29.5	29.5
9	11.8 N	313.9	27.6	27.4	27.3	27.2	27.2	27.2	27.2	27.6	28.0	28.3	29.3
10	12.2 N	312.2	26.9	27.2	27.3	27.3	26.8	26.9	27.1	26.8	25.6	27.0	27.3
11	13.2 N	310.3	27.8	25.5	27.4	27.5	27.7	27.8	27.8	28.1	28.2	29.0	28.9
12	13.2 N	309.5	27.3	27.2	27.2	27.2	27.2	27.2	27.3	27.6	28.1	29.2	29.4
13	13.3 N	307.6	26.9	26.7	26.2	26.5	26.8	26.9	27.2	27.6	27.8	28.1	28.3
14	13.0 N	305.7	27.1	27.1	26.8	26.7	26.7	26.8	26.8	27.3	27.5	28.1	28.8
15	12.9 N	303.7	27.2	27.2	27.1	27.1	27.1	27.1	27.1	27.2	27.8	28.4	28.4
Oct. 2	14.7 N	298.6	27.4	27.3	27.3	27.3	27.4	27.5	27.3	28.0	29.7	30.5	28.4
3	14.8 N	296.4	28.3	28.2	28.1	28.2	28.1	28.2	28.2	28.5	28.6	29.0	28.6
4	15.0 N	293.9	27.7	27.8	28.0	28.0	28.0	28.1	28.1	28.3	27.2	27.6	26.9
5	15.3 N	291.8	28.2	28.2	28.2	28.2	28.1	28.1	28.1	28.3	28.7	28.6	28.8
6	15.2 N	288.8	27.8	27.9	27.8	27.8	27.5	27.8	28.0	28.6	28.8	28.4	29.2
7	14.5 N	286.0	28.2	28.2	28.2	28.2	28.2	28.2	28.3	28.6	29.2	28.9	29.2
8	13.2 N	283.6	28.1	28.0	28.0	28.0	28.0	26.9	28.1	28.5	29.0	28.6	28.6
9	11.4 N	281.4	28.1	28.1	28.0	28.0	28.1	28.1	28.3	28.3	28.4	28.8	28.7
10	10.3 N	280.7	27.3	27.4	27.3	25.6	26.1	26.8	27.4	27.2	27.3	27.7	28.2
26	6.7 N	280.1	28.3	28.2	28.2	28.3	28.2	27.9	27.8	27.0	25.0	24.3	24.5
27	5.7 N	279.9	26.5	25.9	24.9	25.7	25.7	24.3	24.3	24.4	24.5	25.0	25.2
28	4.3 N	280.2	26.1	26.1	26.2	26.2	26.2	26.3	25.8	25.4	25.8	25.6	25.3
29	4.1 N	280.1	25.0	25.1	25.2	25.2	25.3	25.3	25.4	26.0	27.1	27.5	27.6
30	2.9 N	279.9	25.7	25.6	25.4	25.3	25.2	25.1	24.4	24.5	24.8	24.5	24.8
31	4.5 N	278.1	25.3	25.3	24.8	24.5	24.2	25.1	25.3	26.0	25.4	26.4	26.2
Nov. 1	6.1 N	277.0	25.3	24.5	24.6	25.0	24.9	25.3	25.3	26.0	26.3	26.3	26.8
2	4.6 N	277.7	26.2	26.2	26.2	26.2	26.2	26.2	26.3	26.1	26.1	26.3	27.0
3	3.7 N	278.5	23.3	23.5	24.1	24.3	25.1	25.2	25.1	25.1	26.0	25.6	25.0
4	2.5 N	278.9	25.3	25.3	25.2	25.2	25.1	25.2	24.9	24.9	25.0	24.5	25.0
5	1.6 N	279.2	24.7	24.5	24.3	24.2	24.1	23.7	23.9	24.1	24.5	24.9	24.7

temperature, Carnegie, 1928-29

corrected from Assmann-psychrometer readings

local mean hours													Mean
11	12	13	14	15	16	17	18	19	20	21	22	23	
													°C
10.3	10.5	10.2	10.2	10.4	11.4	11.2	11.0	11.0	10.5	10.1	9.9	9.6	10.15
10.3	10.1	10.1	10.4	10.6	10.5	10.6	10.4	10.0	9.6	9.6	9.7	9.9	9.53
11.6	11.9	12.1	13.1	12.5	11.9	11.0	11.0	11.0	11.0	11.0	10.9	10.9	10.77
10.1	10.3	10.2	10.0	9.8	10.0	9.8	10.0	9.6	9.5	9.3	9.1	8.7	10.09
11.6	11.7	11.6	11.5	11.2	11.2	11.3	10.9	10.7	10.6	10.1	10.3	10.1	10.53
10.0	9.6	9.6	9.6	9.6	9.6	9.7	9.8	9.6	9.6	9.5	9.5	9.5	9.62
10.4	10.4	10.4	10.4	10.6	10.5	10.6	10.6	10.5	10.1	10.3	10.1	9.4	10.00
9.7	10.1	10.4	10.0	10.4	10.3	9.9	10.1	8.7	8.4	8.4	8.4	8.4	9.52
10.9	11.6	11.7	11.5	11.4	11.7	11.6	11.5	11.4	11.4	11.5	11.5	11.6	10.42
12.7	13.4	13.6	14.2	15.2	15.6	15.5	15.9	15.6	15.4	15.4	15.4	15.6	13.74
15.5	15.8	16.5	17.4	17.8	18.0	18.1	17.9	17.3	16.7	16.7	16.7	16.9	16.24
19.8	19.4	19.2	18.4	18.3	18.4	18.5	19.1	19.2	19.3	19.7	20.3	20.6	18.40
24.1	25.1	24.7	24.6	24.4	24.4	24.5	24.6	24.3	24.2	23.6	24.2	24.1	22.98
25.6	26.0	26.2	26.2	26.4	26.8	26.2	26.1	25.6	25.4	25.3	25.3	25.2	25.34
26.8	27.5	27.8	28.0	27.9	27.9	27.5	26.3	26.2	26.1	26.0	26.0	25.9	26.24
26.2	26.5	27.0	26.9	27.0	27.0	27.2	27.0	26.2	26.2	26.2	26.1	26.0	25.99
27.0	27.1	27.2	27.3	27.5	27.5	27.4	27.0	26.2	26.1	26.2	26.3	26.3	26.51
27.1	27.6	28.0	28.1	28.2	28.0	27.5	27.0	26.8	26.5	26.4	26.6	26.6	26.82
27.7	28.0	28.2	28.1	28.2	28.2	27.9	27.4	27.1	27.1	27.1	27.0	27.0	27.15
27.2	27.5	27.6	27.6	27.2	27.2	27.0	26.8	26.4	26.3	26.5	26.5	26.2	26.72
27.2	27.4	27.0	26.5	27.0	27.2	27.2	26.7	26.5	25.3	25.1	24.9	25.3	26.35
27.1	27.3	27.4	27.2	26.9	26.7	26.9	26.8	26.4	26.3	26.3	26.3	26.2	26.38
26.7	27.2	27.1	27.2	26.8	26.6	26.5	26.0	26.2	26.2	26.0	26.3	26.2	26.14
27.2	27.2	27.1	27.1	27.1	27.0	26.1	26.2	26.2	26.2	26.2	26.2	26.0	26.36
26.9	27.0	27.2	27.2	27.1	26.8	26.2	26.1	25.6	26.1	25.3	26.1	25.3	26.13
27.3	27.5	27.3	27.2	27.1	27.1	27.1	27.1	26.4	26.2	26.1	26.1	26.1	26.42
28.6	29.1	29.3	29.2	28.8	28.0	28.1	27.8	27.2	27.1	27.1	27.0	26.8	27.23
27.8	28.6	28.3	28.5	28.3	28.3	27.5	26.6	26.4	26.5	26.3	26.3	26.3	27.02
28.2	28.6	29.0	29.6	29.9	29.2	27.7	27.1	27.0	27.0	27.1	26.0	25.8	27.08
29.4	29.0	29.1	30.2	30.6	28.8	28.8	28.7	27.8	27.3	27.2	27.2	27.1	27.50
28.3	28.4	26.7	27.5	27.9	27.7	28.2	27.5	27.3	27.2	27.1	27.2	26.7	27.34
28.2	28.1	27.7	27.7	28.6	28.3	25.8	25.6	25.8	25.4	25.8	26.1	26.2	26.42
28.5	27.1	27.2	27.6	27.6	27.3	27.3	26.8	26.5	26.5	26.1	25.3	24.3	26.67
27.4	27.5	27.3	27.4	27.3	26.1	26.1	26.1	26.2	25.9	26.0	26.1	25.3	26.20
27.0	26.3	26.0	26.6	26.7	25.2	24.2	24.6	24.7	24.7	24.3	24.8	25.1	25.38
27.8	27.3	27.2	26.3	26.8	26.8	26.4	26.7	26.3	26.3	26.5	25.2	25.0	26.40
27.7	27.9	28.0	27.8	27.2	27.3	26.6	25.1	25.2	25.4	25.8	26.1	26.1	26.51
29.2	29.1	29.1	29.0	28.3	28.1	27.9	27.8	27.7	27.7	27.6	27.5	27.3	27.59
28.4	28.4	28.4	28.3	28.1	28.1	27.9	27.8	27.6	27.5	27.4	27.4	27.3	27.72
29.2	29.0	29.3	28.3	28.1	27.3	27.7	27.3	27.1	26.3	26.4	26.4	26.5	27.55
29.1	29.1	28.9	28.6	28.3	28.3	27.9	27.5	27.4	27.3	27.3	27.3	27.2	27.53
30.3	30.2	30.3	29.5	28.9	28.5	28.4	28.3	28.1	27.8	27.9	27.8	27.8	28.15
29.5	30.0	30.2	29.6	29.2	29.5	29.1	27.5	27.6	26.6	25.8	26.5	26.3	27.99
27.2	27.0	27.3	27.7	27.4	27.4	27.3	27.2	27.2	27.4	27.7	27.9	27.9	27.20
29.1	29.2	29.1	29.3	28.9	28.4	28.3	28.2	28.0	27.8	27.7	27.4	27.3	28.10
29.8	29.8	30.1	29.4	28.8	28.5	28.2	28.0	27.9	27.9	27.9	27.9	27.9	28.21
28.4	28.4	28.6	28.4	28.1	27.8	27.7	27.5	27.3	27.2	27.3	27.2	27.2	27.50
29.1	29.2	29.8	30.1	29.3	28.4	28.1	27.7	27.5	27.4	27.3	27.3	27.2	27.84
28.5	28.5	29.0	28.8	28.5	28.3	28.3	28.2	28.1	28.1	28.0	27.8	27.9	27.90
30.4	30.2	29.4	29.1	28.9	28.7	28.5	28.4	28.3	28.3	28.2	28.2	28.2	28.45
28.7	30.2	29.5	30.2	29.6	29.2	25.2	25.4	25.9	26.9	27.3	27.4	27.8	28.14
25.1	26.1	26.9	27.3	28.0	28.2	27.2	28.1	27.9	28.1	28.2	28.2	28.2	27.63
29.0	28.8	28.6	29.2	28.8	28.2	28.2	27.7	27.8	27.6	27.6	28.0	28.1	28.30
29.5	29.3	29.8	30.0	29.6	29.1	28.8	28.4	28.3	28.2	28.2	28.2	28.2	28.55
29.4	29.3	29.2	29.5	28.8	28.5	28.5	28.3	28.3	28.3	28.3	28.2	28.2	28.59
28.7	28.9	29.2	28.8	28.6	28.1	28.2	28.2	28.2	28.2	28.2	28.2	28.1	28.31
28.3	29.1	28.8	28.4	28.3	28.3	28.4	28.1	27.1	26.1	26.2	26.2	27.0	27.97
28.2	28.3	29.1	28.8	28.4	28.3	28.4	28.1	27.8	27.6	27.0	26.6	27.1	27.58
25.6	26.5	26.9	26.9	27.2	27.4	27.2	27.2	27.2	27.3	27.4	27.1	26.8	27.02
25.2	25.3	26.0	25.3	24.3	24.7	24.8	25.3	25.7	25.7	25.8	25.9	26.1	25.27
23.3	23.9	24.2	24.5	24.4	24.2	24.3	24.2	24.2	24.3	24.7	24.6	24.8	25.03
27.7	28.3	29.0	29.2	29.1	28.1	26.1	25.5	25.4	25.7	25.3	25.4	25.5	26.46
24.3	25.0	24.3	24.7	25.2	25.3	25.3	24.9	25.3	25.1	25.3	25.1	25.1	25.01
26.3	26.4	26.3	26.4	26.5	26.4	26.3	26.2	26.2	26.0	26.0	25.6	25.3	25.77
25.7	25.3	26.1	26.2	25.6	25.6	25.9	26.1	25.3	26.0	26.1	26.2	26.2	25.69
27.1	27.1	26.8	26.3	26.3	26.3	26.2	25.6	24.4	23.6	23.2	23.3	23.8	25.79
25.5	25.9	26.3	26.3	26.2	26.5	26.1	25.5	25.4	25.4	25.4	25.4	25.4	25.32
25.2	24.9	24.5	24.3	24.3	24.7	24.7	24.4	24.5	24.5	24.5	24.7	24.6	24.81
25.1	25.3	25.2	24.9	24.9	24.9	24.5	23.8	23.3	23.3	23.3	23.3	23.3	24.28

Table 78. Hourly values of air

Date	Latitude	Longitude east	Values in °C, 00	01	02	03	04	05	06	07	08	09	10
1928	°	°											
Nov. 6	0.8 N	278.8	23.3	23.3	23.3	23.3	23.1	23.1	22.3	22.4	23.2	23.3	23.3
7	0.5 S	278.0	22.3	22.2	22.2	22.2	22.0	21.9	21.9	22.5	22.4	22.3	23.0
8	1.5 S	277.7	19.8	19.5	19.8	20.1	20.0	20.0	19.9	19.6	20.1	20.1	20.2
9	1.3 S	275.2	18.7	18.4	18.3	18.3	18.4	18.4	18;7	19.2	19.2	19.3	19.3
10	1.6 S	273.0	19.1	19.1	19.1	19.2	19.2	19.2	19.3	20.1	20.1	20.2	20.5
11	1.9 S	271.0	20.1	20.0	20.0	19.9	19.9	19.9	19.9	20.3	20.9	21.1	21.0
12	1.3 S	268.7	19.3	19.3	19.3	19.3	19.3	19.3	19.2	19.9	20.2	20.9	21.0
13	1.5 S	266.9	18.4	18.3	18.3	18.4	18.5	18.8	19.1	19.4	19.6	20.0	20.4
14	1.8 S	265.7	19.3	18.3	18.3	18.5	18.7	18.9	19.1	19.3	19.1	19.4	19.9
15	2.5 S	264.2	19.2	19.2	19.2	19.2	19.2	19.3	19.4	20.1	20.3	20.6	20.7
16	3.1 S	261.8	20.1	20.1	20.1	20.1	19.4	19.6	19.4	20.1	20.6	20.4	21.4
17	3.3 S	260.2	20.8	20.8	20.8	20.6	20.7	20.6	21.2	21.3	21.8	22.1	22.1
18	4.0 S	257.4	21.1	21.1	21.0	20.9	20.9	21.1	21.5	21.7	22.2	22.8	22.2
19	4.6 S	254.9	22.3	22.3	22.4	21.8	22.0	22.3	22.9	22.7	23.0	23.3	23.3
20	7.0 S	253.1	22.2	22.2	22.1	22.1	22.2	22.2	22.2	22.3	23.0	23.1	23.2
21	9.2 S	251.6	23.0	22.9	22.9	22.9	22.9	23.1	23.2	23.3	23.5	23.7	24.0
22	12.0 S	249.8	23.2	23.1	23.1	23.1	22.9	23.1	23.3	23.4	23.7	24.1	24.1
23	14.2 S	248.1	23.2	23.2	23.1	23.0	23.2	23.2	23.7	23.4	23.1	23.0	23.9
24	16.7 S	247.0	22.6	23.0	23.1	23.2	23.2	23.1	22.2	23.2	23.2	23.6	23.6
25	19.2 S	245.9	23.1	23.0	23.0	23.1	23.0	22.2	23.0	23.1	23.2	23.3	23.3
26	21.6 S	245.6	22.7	22.7	22.7	22.7	22.5	22.5	22.5	21.4	21.9	22.1	22.6
27	23.3 S	245.2	22.3	21.2	22.1	22.1	22.2	22.9	22.9	23.1	23.3	22.7	22.6
28	24.8 S	244.7	22.4	22.3	22.3	22.2	21.3	21.2	21.8	22.2	23.1	23.1	23.2
29	26.6 S	244.7	22.6	22.7	22.3	22.5	22.4	22.3	22.4	23.1	23.2	22.7	23.2
30	28.1 S	244.9	22.1	22.1	22.1	22.5	21.9	21.9	20.4	19.5	19.4	21.2	21.7
Dec. 1	29.2 S	245.2	22.1	22.0	21.8	21.8	21.9	21.9	22.1	23.2	23.3	23.3	23.3
2	30.6 S	245.7	22.1	22.1	22.0	22.0	21.9	22.0	22.0	22.6	23.2	23.3	23.2
3	31.5 S	247.3	22.1	22.1	22.0	21.8	21.7	21.9	21.8	22.1	22.6	22.2	22.3
4	31.4 S	249.9	22.1	22.1	22.1	22.1	22.0	22.1	22.2	22.2	22.2	22.2	22.3
5	28.9 S	251.3	21.8	22.1	21.7	22.1	21.3	21.7	22.2	22.3	22.3	22.4	22.7
13	28.2 S	250.8	22.3	22.6	22.5	22.5	22.5	23.0	22.9	22.8	23.3	24.3	24.7
14	29.4 S	251.1	22.4	22.4	22.5	22.5	22.5	21.8	22.5	22.9	22.0	22.5	23.2
15	31.1 S	250.5	18.9	19.2	19.3	18.8	18.9	18.5	18.7	19.0	19.2	19.4	19.5
16	32.0 S	249.1	19.0	18.9	18.5	18.5	18.4	18.5	19.0	19.3	19.4	19.4	19.5
17	31.8 S	250.6	19.1	18.9	19.2	19.1	18.8	18.7	19.4	19.3	19.4	19.5	20.0
18	31.9 S	251.0	19.2	19.2	19.3	19.3	19.3	19.4	20.0	20.5	20.9	20.5	20.6
19	32.5 S	252.6	20.0	20.0	20.0	20.1	20.1	20.2	20.5	20.4	20.9	21.7	22.6
20	34.0 S	253.4	18.5	18.0	18.3	18.3	18.5	18.7	19.3	19.3	19.5	20.2	20.3
21	35.3 S	254.6	19.4	19.3	19.3	19.3	19.3	19.4	19.6	19.5	20.0	20.4	20.4
22	36.9 S	255.9	18.4	17.8	17.3	17.4	17.5	17.3	17.0	16.7	17.4	17.6	17.3
23	38.7 S	257.1	17.2	17.2	17.1	16.9	16.9	16.9	16.8	16.7	16.7	16.7	16.5
24	39.9 S	259.0	16.0	16.1	16.3	16.3	16.3	16.4	16.5	16.4	16.5	16.6	16.6
25	40.3 S	261.0	14.9	14.8	14.8	14.8	14.7	14.8	14.9	15.2	15.5	15.8	16.0
26	40.4 S	262.5	14.8	14.6	14.6	14.5	14.5	14.5	14.7	15.4	15.9	16.5	17.3
27	39.9 S	263.7	15.6	15.6	15.6	15.7	15.8	16.2	16.4	16.4	16.4	16.4	16.4
28	38.4 S	265.8	16.7	16.6	16.7	16.8	16.9	16.9	17.2	17.4	17.4	17.4	17.7
29	36.6 S	267.0	16.4	16.5	16.4	16.5	16.1	16.1	16.3	16.7	17.8	18.5	18.2
30	34.5 S	268.2	17.3	17.3	17.3	17.2	17.3	17.4	18.2	18.4	19.0	19.2	19.2
31	32.5 S	270.0	18.2	17.9	17.8	18.0	18.2	18.4	18.4	18.6	19.3	19.7	19.9
1929													
Jan. 1	32.2 S	270.9	19.3	19.3	19.3	19.2	19.2	19.3	20.1	20.6	21.4	21.4	22.2
2	31.9 S	271.1	20.1	20.0	20.1	20.0	19.8	19.9	20.7	21.3	21.3	21.9	22.5
3	31.9 S	271.7	19.3	19.2	19.1	19.1	19.1	19.1	20.3	21.4	21.6	21.3	21.1
4	31.8 S	272.7	19.0	19.0	19.1	19.1	19.0	19.0	19.1	19.4	19.9	19.9	19.9
5	31.0 S	273.4	19.9	19.7	19.4	19.2	19.2	19.3	19.9	20.2	20.1	20.2	20.3
6	28.9 S	274.7	20.3	20.3	20.2	20.1	20.0	20.0	20.1	21.0	21.4	21.8	21.8
7	27.0 S	276.0	19.4	19.1	19.1	19.2	19.3	19.0	19.3	19.6	19.3	19.6	19.8
8	25.0 S	277.8	18.3	18.1	18.6	18.5	18.2	18.3	18.6	18.8	19.0	19.2	20.0
9	23.1 S	278.8	19.1	19.0	19.0	19.1	19.0	19.0	19.1	19.1	19.1	19.7	20.1
10	21.4 S	279.5	18.9	18.9	18.8	18.9	18.9	19.0	19.0	19.0	19.1	19.5	19.9
11	19.1 S	280.7	19.0	19.0	18.9	18.9	19.0	19.0	19.1	19.1	19.4	19.4	19.9
12	16.7 S	281.4	19.9	19.9	20.0	20.1	20.2	20.4	20.5	20.6	20.7	21.0	21.1
13	14.1 S	282.1	21.3	21.3	21.4	21.5	21.5	21.3	21.4	21.6	21.9	21.9	22.6
14	12.3 S	282.8	21.1	21.0	20.9	20.8	20.6	20.6	20.4	20.9	21.3	22.0	22.6
Feb. 6	11.9 S	281.4	21.1	21.2	21.8	22.3	22.9	23.0	23.1	23.5	23.4	23.6	23.8
7	10.2 S	280.1	23.0	22.6	22.6	22.7	22.8	22.9	23.0	23.7	24.8	24.9	25.0
8	10.0 S	277.8	24.1	24.1	24.1	24.1	24.0	24.1	24.2	24.8	24.9	25.1	25.2
9	10.4 S	275.8	24.0	23.9	23.9	23.9	23.9	24.0	24.0	24.3	24.2	24.7	25.0
10	10.8 S	275.0	24.0	23.9	23.9	23.9	25.0	24.1	24.1	24.4	24.8	25.8	26.1
11	10.7 S	274.1	24.8	24.7	24.6	24.4	24.3	24.3	24.3	24.8	24.9	25.9	26.6
12	11.0 S	272.6	24.1	24.1	24.0	23.9	23.8	23.7	23.8	24.3	24.2	24.6	24.7
13	12.6 S	270.3	23.8	23.7	23.6	23.5	23.4	23.4	23.6	23.6	23.7	23.0	23.1
14	14.4 S	267.8	22.9	22.6	22.5	22.4	22.3	22.4	22.4	23.0	23.0	23.0	23.3

temperature, Carnegie, 1928-29--Continued

local mean hours													Mean
11	12	13	14	15	16	17	18	19	20	21	22	23	
													°C
24.3	24.7	24.3	23.8	24.1	24.3	23.6	23.1	22.8	22.4	22.5	22.5	22.5	23.28
22.4	23.1	23.1	23.2	22.7	22.8	21.9	21.3	21.1	20.9	20.6	20.3	20.1	22.02
20.2	20.2	19.9	19.5	19.4	19.3	19.2	19.1	19.0	19.0	18.9	18.8	18.8	19.60
19.4	19.5	20.1	20.3	20.1	19.7	19.6	19.2	19.2	19.2	19.2	19.1	19.1	19.16
20.7	20.6	21.1	21.1	20.5	20.7	20.9	20.3	20.2	20.2	20.3	20.3	20.3	20.10
20.8	20.7	20.9	21.1	20.9	21.0	20.9	20.3	20.1	19.9	19.8	19.5	19.3	20.34
21.1	22.1	21.3	21.1	20.6	19.8	19.3	19.2	19.1	18.8	18.5	18.7	18.5	19.80
20.4	20.9	21.1	21.6	21.3	20.3	19.3	18.8	19.1	19.1	19.2	19.2	19.3	19.53
20.1	20.2	20.1	19.7	19.6	19.7	19.4	19.3	19.2	19.2	19.2	19.3	19.2	19.29
20.8	20.8	20.9	21.2	20.7	20.0	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.06
21.8	22.0	21.7	21.7	21.6	21.5	21.2	21.0	20.9	20.8	20.8	20.8	20.8	20.75
22.2	22.1	22.1	22.0	21.6	21.1	21.2	21.1	21.1	21.1	21.2	21.2	21.1	21.33
22.4	22.3	22.5	22.8	22.5	22.4	22.2	22.2	22.2	22.3	22.2	22.2	22.2	21.95
23.4	23.4	23.4	23.1	22.9	22.7	22.7	22.5	22.3	22.3	22.2	22.2	22.2	22.65
23.2	24.0	24.1	23.2	22.7	22.7	23.1	22.9	23.0	23.1	23.1	23.1	23.1	22.84
24.1	24.1	24.1	23.3	23.4	23.5	23.4	23.3	23.3	23.3	23.2	23.2	23 2	23.37
24.1	24.1	24.1	23.9	23.4	23.3	23.3	23.2	23.2	23.2	23.1	23.1	23.2	23.43
24.1	24.2	24.1	23.3	23.2	23.3	23.1	23.1	22.8	22.4	22.2	22.3	22.2	23.18
23.2	23.2	23.9	23.5	23.3	23.1	22.5	22.6	22.8	23.2	23.2	23.2	23.1	23.12
23.4	23.3	23.3	23.2	23.0	23.0	23.1	23.1	23.0	22.9	22.9	22.8	22.5	23.03
23.2	23.1	22.4	23.0	22.8	22.8	22.8	22.7	22.3	22.2	22.1	22.5	22.5	22.53
23.2	23.3	23.5	23.6	23.3	23.2	23.2	23.1	22.8	22.6	22.5	22.5	22.4	22.78
23.3	23.2	23.2	23.2	23.1	23.1	23.0	22.9	22.6	22.5	22.5	22.6	22.5	22.62
23.2	23.2	23.0	23.1	22.6	22.6	22.4	22.4	22.2	22.1	22.2	21.8	21.5	22.57
22.2	22.7	23.1	22.7	22.4	22.4	22.4	22.3	22.2	22.1	22.2	22.2	22.2	21.91
23.2	23.3	23.7	23.7	23.5	23.1	23.1	23.0	22.5	22.4	22.4	22.3	22.2	22.71
23.4	23.5	23.4	23.2	23.2	23.1	22.7	22.6	22.3	22.2	22.2	22.2	22.2	22.61
22.9	23.1	23.2	23.2	23.0	22.9	22.6	22.3	22.2	22.1	22.1	22.1	22.1	22.35
22.4	22.5	22.5	22.6	22.4	22.4	22.3	22.2	22.1	22.1	22.2	22.2	22.1	22.23
23.0	23.1	23.1	23.1	23.2	23.2	23.1	22.5	22.7	22.7	22.6	22.6	22.5	22.50
24.3	23.7	23.8	24.0	23.5	23.4	23.4	23.3	23.4	23.3	22.0	22.7	22.5	23.20
22.5	23.4	23.5	23.7	23.7	22.5	22.4	19.8	19.4	19.4	19.3	19.3	18.9	21.88
19.6	19.5	19.2	19.1	17.5	17.4	17.5	17.6	18.3	18.5	18.4	18.5	18.7	18.72
19.6	19.6	20.3	20.3	20.3	20.4	20.2	19.9	19.4	19.3	19.3	19.3	19.1	19.39
20.4	20.6	20.7	20.9	20.9	20.9	20.3	19.9	19.4	19.3	19.3	19.3	19.2	19.69
21.0	20.8	20.8	20.9	21.1	20.8	20.5	20.3	20.2	20.1	20.1	20.1	20.1	20.21
22.5	21.9	21.2	21.3	20.9	20.5	20.3	20.3	20.0	19.5	19.5	19.2	19.1	20.53
20.5	20.5	20.5	20.4	20.4	20.4	20.2	20.2	20.0	19.8	19.6	19.6	19.5	19.60
20.4	20.4	20.4	20.5	20.5	20.5	19.6	19.4	19.1	18.7	18.6	18.5	18.4	19.62
17.3	17.4	17.4	17.4	17.4	17.6	17.4	17.2	17.2	16.8	17.3	17.3	17.3	17.36
16.5	16.5	16.5	16.6	16.5	16.6	16.4	16.4	16.3	16.2	16.2	16.1	15.9	16.60
16.6	16.5	16.5	16.4	16.3	15.7	15.5	15.4	15.3	15.2	15.1	15.1	14.9	16.02
16.2	16.3	16.3	16.3	16.3	16.2	15.8	15.4	15.4	15.3	15.1	15.0	14.8	15.44
17.3	17.3	17.3	17.6	17.9	17.9	17.5	17.2	16.5	16.3	15.9	15.7	15.7	16.14
17.2	17.4	17.4	17.3	17.3	17.3	17.0	16.7	16.6	16.6	16.6	16.7	16.7	16.55
18.0	18.4	18.4	18.7	18.4	17.5	17.5	17.5	17.2	17.3	17.2	16.5	16.4	17.36
18.5	18.5	19.3	19.2	18.6	18.7	18.9	18.6	18.5	18.2	17.7	17.5	17.4	17.71
19.4	19.3	19.2	18.5	18.6	19.0	19.0	18.8	18.4	18.3	18.3	18.3	18.3	18.38
20.3	20.6	21.0	19.4	19.3	20.3	20.4	19.5	19.4	19.5	19.5	19.4	19.4	19.27
23.2	23.4	22.4	23.6	24.7	23.4	23.2	22.8	22.4	21.2	20.5	20.4	20.3	21.37
22.3	21.3	22.5	25.2	21.8	20.4	20.3	20.3	20.2	20.1	19.9	19.8	19.5	20.88
20.9	21.1	21.2	21.8	22.0	21.1	20.1	19.9	19.6	19.3	19.2	19.1	19.1	20.21
20.5	20.9	21.1	21.9	21.9	22.0	22.2	22.0	21.1	20.1	20.0	20.0	19.9	20.25
20.7	21.5	22.2	22.0	22.1	22.8	22.6	22.1	21.1	20.6	20.6	20.6	20.6	20.70
22.0	22.0	21.9	22.0	21.7	21.6	21.1	20.9	20.1	20.0	19.9	19.2	19.1	20.77
20.1	20.1	20.0	19.9	19.4	18.9	17.9	18.3	18.8	18.6	18.7	18.8	18.6	19.20
20.4	20.1	20.1	19.9	19.9	20.1	20.0	19.9	19.2	19.0	19.0	19.0	19.1	19.22
20.0	19.9	20.1	20.6	20.4	20.2	20.0	19.8	19.2	19.1	19.1	19.0	18.9	19.48
20.1	20.6	20.7	20.6	20.0	19.9	19.9	19.5	19.3	19.2	19.0	19.0	19.0	19.45
20.0	20.0	20.0	20.1	20.1	20.1	20.0	19.9	19.8	19.9	19.9	19.9	20.0	19.60
22.0	22.1	22.6	22.8	22.6	22.2	21.9	21.6	21.3	21.2	21.3	21.4	21.2	21.19
23.0	22.9	22.9	22.8	22.7	22.2	22.1	22.0	21.7	21.6	21.6	21.5	21.2	21.91
22.1	22.5	22.6	21.9	22.0	21.1	20.3	19.1	18.8	18.2	18.0	17.7	17.9	20.60
24.0	24.5	25.3	25.6	25.7	25.1	24.9	24.0	23.7	23.3	23.2	23.1	23.1	23.55
25.6	25.8	24.9	24.9	24.8	24.6	24.5	24.1	24.1	24.2	24.3	24.2	24.1	24.09
25.5	25.6	25.2	25.3	25.0	24.8	24.8	24.6	24.3	24.1	24.1	24.1	24.0	24.59
25.0	25.4	25.1	25.3	24.9	24.5	24.6	24.9	24.3	24.2	24.2	24.1	24.1	24.43
26.4	26.8	27.0	27.3	27.6	27.1	26.6	26.0	25.3	25.1	25.0	24.9	24.9	25.38
26.6	26.6	26.4	26.8	26.0	25.1	24.9	24.8	24.6	24.5	24.4	24.2	24.1	25.11
24.8	24.7	24.3	24.2	24.1	24.1	24.0	24.1	23.9	23.9	23.8	23.8	23.8	24.11
23.0	23.3	23.9	23.7	23.3	23.1	23.1	23.1	23.0	23.1	23.1	22.9	23.0	23.33
23.6	23.3	23.3	23.4	23.0	22.8	22.9	23.0	22.7	22.6	22.6	22.5	22.5	22.83

Table 78. Hourly values of air

Date	Latitude	Longitude east	Values in °C, 00	01	02	03	04	05	06	07	08	09	10
1929	°	°											
Feb. 15	15.8 S	265.1	22.5	22.5	22.6	22.6	22.6	23.0	22.9	22.2	22.8	23.4	24.0
16	15.3 S	262.4	22.7	22.8	22.7	22.9	23.0	23.0	23.0	23.5	24.1	23.6	23.3
17	14.8 S	259.2	23.4	22.5	23.1	23.3	23.4	22.0	23.2	23.0	23.4	23.6	23.9
22	12.6 S	247.7	24.6	24.5	24.5	24.6	24.7	24.7	24.7	24.9	25.0	25.1	25.1
23	12.5 S	244.9	24.9	24.8	24.8	24.8	24.8	25.0	25.0	25.1	25.7	26.2	26.0
24	12.7 S	242.4	25.3	25.2	25.2	25.1	25.0	25.2	25.2	25.5	25.6	25.9	26.1
25	12.8 S	240.6	26.0	25.9	25.9	25.9	25.9	25.9	25.8	25.9	26.2	26.6	27.0
26	13.0 S	238.7	26.0	26.0	25.9	25.9	25.9	25.9	25.9	26.0	26.9	26.5	26.5
27	13.5 S	235.9	26.2	26.2	25.9	26.0	26.1	26.1	26.2	26.5	27.0	27.1	27.2
28	14.9 S	233.8	26.2	26.2	26.1	26.1	26.3	26.2	26.2	26.3	26.9	27.0	27.0
Mar. 1	16.5 S	231.9	26.9	26.8	26.8	26.7	26.8	26.7	26.6	27.0	27.8	27.9	28.8
2	17.0 S	230.2	27.0	26.9	26.8	26.7	26.7	26.6	26.9	27.3	27.7	27.7	27.9
3	17.1 S	228.3	27.0	27.0	26.9	26.9	26.9	26.9	26.9	27.1	27.4	27.8	28.6
5	17.1 S	224.6	27.3	27.2	27.1	27.1	27.0	27.0	26.9	27.1	27.5	28.0	28.4
6	17.2 S	223.4	27.3	27.2	27.2	27.1	27.3	27.2	27.2	27.5	28.1	29.0	28.2
7	17.4 S	221.1	27.8	27.4	27.2	27.3	27.3	27.1	27.0	27.8	28.1	28.4	29.0
8	17.8 S	219.2	27.5	27.3	27.2	27.2	27.1	27.1	27.2	27.5	28.0	28.1	28.2
9	17.6 S	218.0	27.9	27.9	27.8	27.7	27.7	27.6	27.5	27.9	28.3	28.8	28.8
10	18.0 S	215.9	28.0	28.0	28.0	28.0	28.0	28.1	28.1	28.2	28.9	29.1	29.5
11	18.1 S	214.4	27.1	27.2	27.9	27.7	26.1	26.0	26.3	26.4	27.2	27.6	27.6
12	17.9 S	212.0	27.1	26.6	26.8	27.0	27.2	25.8	26.0	27.0	27.8	28.0	28.3
21	16.8 S	209.2	26.1	26.8	26.9	27.0	27.3	27.2	27.2	27.4	28.0	28.8	29.3
22	17.6 S	208.2	27.8	27.9	27.7	27.8	27.9	27.9	26.5	26.9	26.0	26.9	26.8
23	17.2 S	207.3	26.9	26.9	26.9	26.9	26.9	26.9	26.9	27.7	28.6	28.0	28.0
24	16.9 S	206.3	27.5	27.4	27.3	27.2	27.1	27.0	27.1	27.5	27.6	27.9	28.7
25	16.5 S	204.0	28.0	28.0	28.0	28.1	28.0	28.0	28.0	28.4	28.5	28.8	28.9
26	16.1 S	201.6	28.2	28.1	28.3	27.8	27.6	27.9	28.0	28.1	27.4	28.9	29.7
27	15.7 S	199.4	28.5	25.0	26.2	27.1	27.5	27.9	28.0	28.2	28.5	28.8	28.9
28	15.5 S	198.0	28.3	26.0	26.1	26.6	26.8	27.0	27.3	27.7	27.9	28.8	29.5
29	15.3 S	196.7	28.0	28.0	28.0	28.0	27.9	27.9	27.9	28.5	29.4	29.3	29.6
30	14.7 S	194.4	28.2	28.2	28.1	28.0	28.1	28.0	28.0	28.7	29.3	29.3	29.2
31	14.7 S	192.1	28.1	28.2	28.1	28.1	28.0	27.9	27.9	28.3	28.7	28.8	27.7
Apr. 22	12.7 S	188.4	29.0	29.0	29.1	29.1	29.0	28.9	28.9	28.9	29.3	28.0	28.5
23	11.3 S	188.4	27.0	27.4	27.9	28.0	28.1	28.3	28.3	28.4	29.0	29.1	29.2
24	8.7 S	189.0	29.0	28.9	29.1	28.9	28.9	28.5	28.7	29.1	29.1	29.4	29.6
25	7.6 S	188.2	28.7	28.6	28.8	28.2	28.3	27.4	27.0	26.7	27.1	27.6	28.0
26	6.7 S	187.6	26.6	26.6	27.1	27.5	27.8	27.9	28.0	28.4	29.3	30.3	30.4
27	5.1 S	187.6	28.1	28.0	28.0	27.9	27.9	27.9	27.1	27.1	28.3	30.1	30.4
28	3.8 S	187.4	27.8	27.8	28.0	27.9	27.7	27.6	27.7	28.1	28.5	28.8	29.0
29	1.8 S	186.6	27.8	27.6	27.7	27.6	27.7	27.6	27.6	27.8	28.0	28.1	28.1
30	0.4 N	185.9	26.6	27.0	27.1	27.1	27.1	27.0	27.0	27.0	27.5	27.5	27.6
May 1	2.5 N	184.9	27.7	27.7	27.7	27.7	27.0	27.2	26.8	26.1	26.6	27.6	27.3
2	4.4 N	183.6	27.6	27.9	27.9	27.8	27.7	27.8	27.8	27.9	28.1	27.2	27.3
3	6.5 N	182.3	27.4	27.2	27.1	27.0	27.0	27.3	27.4	27.6	27.9	27.9	28.0
4	8.2 N	181.1	27.2	27.1	27.1	27.0	27.0	27.0	26.9	27.2	27.3	27.6	28.0
5	10.8 N	180.5	27.1	27.0	26.9	27.0	26.9	26.8	26.8	26.9	27.1	27.3	27.4
	Crossed International Date Line												
7	13.5 N	177.4	26.4	26.4	26.2	26.1	25.8	25.4	25.8	26.2	26.6	26.9	27.2
8	15.4 N	174.7	25.9	26.0	26.0	26.0	26.0	25.9	26.0	26.1	26.8	26.2	26.5
9	16.5 N	171.9	26.3	26.0	26.0	26.0	26.0	26.0	26.0	26.1	26.0	26.2	26.2
10	18.5 N	169.0	25.9	25.9	25.8	25.7	25.5	25.5	25.2	25.5	25.9	26.0	26.4
12	20.3 N	163.7	26.0	25.9	25.7	25.7	25.7	25.7	25.3	25.1	24.3	24.2	24.8
13	20.2 N	161.2	25.6	25.5	25.5	25.3	25.2	25.1	25.3	26.1	26.0	26.2	26.4
14	19.5 N	158.5	26.0	26.0	26.0	25.8	25.7	25.7	25.8	26.4	26.5	26.9	26.9
15	18.7 N	156.1	26.2	26.3	26.2	26.3	26.3	26.3	26.0	25.9	25.8	26.0	26.7
16	17.5 N	153.4	27.0	27.0	27.0	26.3	26.8	26.8	26.9	27.0	27.3	27.7	27.9
17	16.1 N	150.9	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.1	27.4	27.4
18	14.9 N	148.3	27.3	27.1	27.1	27.1	27.0	27.0	27.0	27.2	27.7	28.0	28.3
19	14.0 N	146.0	27.7	27.4	27.3	27.2	27.2	27.2	27.2	27.9	28.0	28.1	28.1
26	16.1 N	144.2	28.2	27.8	27.5	27.6	27.7	27.6	27.7	28.1	28.3	28.8	28.9
27	18.6 N	144.0	28.3	28.1	28.0	27.8	27.8	27.8	27.9	28.2	28.4	28.8	28.8
28	21.5 N	144.2	28.2	28.2	28.1	28.1	28.0	27.9	28.1	28.2	28.9	29.1	29.1
29	23.4 N	144.2	28.5	28.1	28.1	27.9	27.3	27.1	27.3	27.7	27.7	28.0	28.1
30	25.3 N	144.1	26.5	25.8	26.2	26.3	26.3	26.1	26.5	27.1	27.2	28.1	28.7
31	26.4 N	144.4	26.9	26.5	26.1	25.5	25.2	25.1	25.2	25.7	25.5	25.3	25.3
June 1	28.5 N	144.0	24.4	24.4	24.5	24.4	24.4	24.2	24.2	24.3	24.6	24.8	25.4
2	30.2 N	143.9	23.0	22.2	22.0	21.6	21.3	21.0	21.0	21.0	20.9	20.9	20.3
3	31.1 N	144.3	20.0	19.9	19.8	19.6	19.6	19.6	19.5	19.7	20.0	20.2	20.3
4	32.7 N	142.3	20.4	20.4	20.3	20.2	20.2	20.2	20.3	20.4	20.5	20.7	21.0
5	34.0 N	141.2	22.7	22.8	22.6	22.6	22.6	22.7	22.9	23.1	23.2	23.2	23.8
6	34.9 N	140.2	21.2	21.0	20.5	20.4	20.4	20.2	20.2	20.2	20.2	20.5	21.0

temperature, Carnegie, 1928-29--Continued

local mean hours													Mean
11	12	13	14	15	16	17	18	19	20	21	22	23	
													°C
24.1	24.1	23.8	24.1	23.9	23.4	23.6	23.0	22.9	22.9	22.9	22.9	22.8	23.15
23.4	24.3	24.6	24.2	24.0	24.0	23.9	23.6	23.3	23.5	23.5	23.4	23.4	23.49
24.1	24.7	24.8	24.8	24.2	24.0	24.2	24.0	23.7	23.6	23.6	23.5	23.4	23.64
25.3	25.7	26.0	26.0	25.9	25.2	25.1	25.0	24.9	24.9	24.9	25.0	25.0	25.05
25.9	26.0	26.4	26.1	26.2	25.7	25.6	25.6	25.5	25.6	25.4	25.3	25.3	25.49
26.9	26.9	26.9	26.9	26.9	26.9	26.8	26.5	26.2	26.1	26.0	26.0	26.1	26.02
27.1	27.1	27.3	27.3	27.1	26.7	26.7	26.6	26.3	26.3	26.2	26.1	26.0	26.41
26.5	26.8	26.8	27.1	26.9	26.8	26.9	26.7	26.4	26.3	26.3	26.3	26.3	26.40
27.5	27.8	27.9	27.9	27.0	27.0	26.9	26.9	26.7	26.5	26.4	26.4	26.3	26.74
27.0	27.0	27.5	28.0	27.7	27.5	27.3	27.2	27.0	26.9	26.9	26.9	26.9	26.85
28.9	28.9	28.9	29.0	28.0	27.7	27.6	27.3	27.1	27.1	27.0	27.0	26.9	27.51
27.8	28.3	28.5	28.0	27.8	27.7	27.6	27.5	27.3	27.3	27.2	27.2	27.1	27.40
28.4	28.7	28.9	29.0	28.8	27.9	27.6	27.5	27.4	27.2	27.2	27.2	27.1	27.60
28.7	28.9	28.8	29.0	28.8	28.8	27.9	27.9	27.5	27.3	27.4	27.4	27.3	27.76
28.6	28.9	29.4	28.7	29.1	29.1	29.1	28.5	28.1	28.0	28.0	27.9	28.0	28.11
29.0	29.0	29.1	29.0	29.2	28.8	28.1	28.0	27.9	27.8	27.8	27.7	27.6	28.06
28.3	28.4	28.4	28.5	28.7	28.8	28.3	28.1	28.0	27.9	27.9	27.9	27.9	27.90
28.9	29.0	29.0	29.0	28.8	28.6	28.4	28.2	28.1	28.0	28.1	28.0	28.0	28.25
29.2	29.1	28.1	29.3	27.0	26.0	26.4	25.9	25.1	25.7	26.2	26.6	26.9	27.64
26.9	26.9	27.6	26.0	25.9	24.8	25.2	26.0	26.2	26.8	27.0	27.0	27.0	26.68
29.1	28.0	27.7	27.0	27.5	27.8	28.0	28.0	27.8	27.1	26.8	24.1	24.4	27.12
28.7	28.9	28.5	26.7	26.1	27.0	27.2	27.1	26.5	26.9	27.2	26.8	27.4	27.38
26.0	26.9	27.5	28.0	28.1	28.2	28.3	27.7	27.4	27.3	27.2	27.1	27.0	27.37
28.2	29.2	29.5	29.7	29.2	29.0	28.9	28.7	27.9	27.7	27.7	27.6	27.5	27.98
28.6	28.8	28.8	28.5	28.1	28.1	28.2	28.1	28.1	28.1	28.2	28.2	27.8	27.91
29.3	29.4	29.1	29.0	28.9	27.8	28.3	27.9	27.9	28.0	28.0	28.0	28.2	28.35
29.7	27.9	29.2	28.9	29.0	28.6	28.6	27.3	28.0	28.0	28.0	28.2	28.5	28.33
28.9	28.9	29.0	28.9	28.9	26.9	27.8	28.6	28.6	28.6	28.5	28.6	28.0	28.12
29.7	29.6	29.7	29.7	29.7	29.5	29.2	29.0	28.8	28.5	28.4	28.0	28.0	28.33
30.0	30.6	31.0	30.4	29.0	29.7	29.0	28.9	28.8	28.7	28.5	28.4	28.3	28.91
29.6	29.7	30.4	28.2	27.7	28.0	28.7	28.0	26.7	26.9	27.5	27.8	27.9	28.34
29.7	29.5	29.2	29.1	28.9	29.1	28.8	28.5	28.7	28.0	27.9	27.9	28.0	28.46
29.2	29.5	29.5	29.4	28.0	25.2	25.6	25.7	26.0	26.2	24.7	25.3	26.2	27.84
29.3	29.4	29.2	29.1	29.1	29.1	28.6	28.7	28.9	28.9	28.8	29.0	29.0	28.66
29.7	28.0	29.2	27.0	27.1	28.3	29.0	28.9	28.8	28.6	28.9	28.9	28.8	28.77
28.4	29.9	30.4	31.2	30.0	30.1	28.6	28.2	28.1	28.1	28.0	27.6	27.2	28.43
30.0	29.8	28.4	28.1	27.6	28.4	29.8	29.2	29.0	28.0	27.9	28.0	28.1	28.43
31.1	30.1	30.0	30.4	27.1	27.7	28.0	28.1	28.0	28.0	27.9	27.8	27.9	28.45
29.1	29.2	29.1	28.7	28.6	28.5	28.6	28.4	28.1	28.0	28.0	27.9	27.9	28.29
28.2	28.3	28.2	28.0	28.0	28.1	28.0	27.8	27.6	27.7	27.7	27.7	27.1	27.83
27.6	27.8	27.7	27.6	27.5	27.5	27.5	27.4	27.3	27.3	27.4	27.5	27.6	27.34
27.9	28.1	27.9	28.5	28.1	28.1	28.3	28.1	28.0	27.9	27.8	26.6	27.1	27.58
28.2	28.0	28.2	28.1	28.1	28.1	26.1	25.4	26.0	26.3	26.9	27.1	27.0	27.44
28.2	28.2	28.3	27.0	27.7	27.0	27.0	26.9	26.9	27.0	26.1	26.3	27.0	27.31
27.9	27.5	27.8	28.0	26.9	27.1	27.3	26.9	24.8	26.2	26.6	27.0	27.1	27.10
27.3	27.3	27.3	27.1	26.8	26.8	26.5	26.3	26.5	26.3	26.3	26.6	26.5	26.87
27.1	27.0	27.0	26.8	26.3	25.9	25.7	26.0	26.0	25.9	26.0	25.1	25.8	26.23
26.9	26.7	26.4	26.4	26.1	26.0	26.1	26.0	26.0	25.9	26.1	26.2	26.0	26.18
26.1	26.3	26.7	26.7	26.2	26.2	26.1	26.0	26.0	25.9	25.4	25.8	25.5	26.07
26.5	26.5	26.4	26.4	26.3	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	25.98
25.4	26.1	26.7	26.6	26.2	26.0	25.9	25.7	25.5	25.5	25.5	25.5	25.5	25.60
26.4	26.7	26.4	26.5	26.4	26.1	26.3	26.2	26.1	26.0	26.0	26.0	26.0	25.97
26.9	27.0	27.0	26.9	26.6	26.7	26.6	26.6	26.4	26.5	26.6	26.7	26.7	26.45
27.0	27.3	27.1	27.0	27.0	27.0	27.1	27.0	27.0	27.0	27.0	27.1	27.3	26.66
28.0	28.1	27.5	27.9	27.5	27.6	27.5	27.4	27.4	27.3	27.2	27.1	27.4	27.32
27.5	27.7	27.8	27.7	27.5	27.6	27.8	27.6	27.4	27.4	27.4	27.5	27.4	27.34
28.5	28.9	28.9	28.1	28.1	28.1	28.1	28.0	28.0	27.8	27.8	27.8	27.8	27.78
28.4	29.0	29.0	28.9	28.1	28.1	28.1	28.1	28.0	28.0	28.0	28.0	28.0	27.96
29.0	29.0	29.0	28.9	28.4	28.4	28.4	28.4	28.2	28.2	28.1	28.2	28.5	28.29
28.9	28.9	28.9	28.6	28.6	28.7	28.8	28.5	28.5	28.3	28.2	28.2	28.3	28.39
29.1	29.1	29.1	29.1	29.0	29.0	29.2	29.0	28.7	28.4	28.4	28.7	28.7	28.64
28.1	28.1	28.1	28.1	27.9	28.0	28.1	28.1	27.5	27.5	27.3	27.1	26.6	27.76
28.2	27.9	28.3	29.1	29.1	28.2	27.5	27.5	27.2	27.1	27.0	26.8	27.0	27.32
26.3	26.6	27.7	27.7	27.2	27.1	27.1	26.9	26.2	25.6	25.3	25.2	24.6	26.08
26.2	26.0	25.3	25.3	25.1	24.2	24.0	23.6	23.3	23.2	23.1	23.2	23.2	24.39
20.9	21.0	20.8	20.7	20.9	21.1	20.7	20.5	20.2	20.2	20.1	20.1	20.0	20.93
20.7	20.7	20.7	20.8	20.9	20.9	20.7	20.3	20.2	20.2	20.3	20.5	20.5	20.23
21.2	21.4	21.7	22.0	22.0	22.0	21.6	21.7	22.0	22.2	22.2	22.8	22.6	21.25
24.1	23.3	23.5	23.5	23.6	23.4	22.6	22.5	21.2	20.7	21.0	20.9	21.0	22.65
21.0	21.7	21.9	21.2	20.7	20.9	21.1	20.9	20.5	20.5	20.3	20.2	20.1	20.70

Table 78.. Hourly values of air

Date	Latitude	Longitude east	Values in °C, 00	01	02	03	04	05	06	07	08	09	10
1929	°	°											
June 7	34.9 N	139.9	19.9	19.3	19.2	18.7	18.3	18.2	17.8	17.6	17.6	17.4	16.3
25	34.7 N	141.0	21.6	22.7	22.8	22.8	21.0	20.2	22.1	22.2	22.6	23.0	23.2
26	36.0 N	142.1	22.0	20.9	20.3	20.1	20.1	20.1	20.0	20.1	20.6	21.6	21.9
27	36.7 N	143.6	19.5	19.1	19.1	19.0	19.1	19.3	19.8	20.0	20.1	20.6	21.0
28	36.8 N	145.4	20.8	20.7	20.5	20.5	20.4	20.1	20.0	20.1	20.0	20.1	19.9
29	37.8 N	145.5	18.7	18.1	18.0	18.0	17.9	17.9	17.9	17.8	17.9	18.1	18.3
30	38.1 N	147.1	18.3	18.2	18.2	17.8	17.7	17.7	17.7	17.5	17.5	17.9	17.1
July 1	38.7 N	147.7	17.2	16.9	16.8	16.3	16.1	16.1	16.2	16.5	17.0	17.8	18.0
2	39.8 N	149.5	15.7	15.4	15.7	15.6	15.9	15.9	15.9	16.2	16.1	16.7	16.3
3	40.4 N	151.1	15.4	15.2	15.0	14.6	14.2	14.2	14.2	14.3	14.2	14.6	15.0
4	41.3 N	153.1	14.1	14.1	13.2	12.5	12.3	12.2	12.2	12.1	11.8	11.3	11.3
5	42.6 N	155.6	11.2	10.9	10.9	10.8	10.7	10.7	10.6	10.7	10.6	11.0	11.2
6	43.8 N	158.3	10.8	10.4	10.4	10.3	10.2	10.1	10.1	10.1	10.1	10.2	10.2
7	45.4 N	159.6	10.2	10.2	10.0	9.6	9.4	9.3	9.2	9.1	8.7	9.0	8.9
8	46.9 N	163.0	9.7	9.4	9.6	9.2	9.2	9.2	8.9	8.2	8.2	8.4	8.5
9	47.0 N	166.6	7.3	7.4	7.5	7.2	7.2	7.2	7.2	7.2	7.2	7.3	7.4
10	46.7 N	169.5	8.0	7.9	7.6	7.4	7.3	7.3	7.3	7.2	7.2	7.2	7.4
11	46.0 N	171.7	8.0	7.9	7.7	7.5	7.3	7.2	7.2	7.1	7.2	7.3	7.3
12	45.3 N	173.1	9.2	9.1	9.2	9.1	9.1	9.2	9.2	9.2	9.2	9.3	9.4
13	46.2 N	174.1	9.5	9.6	9.4	9.3	9.3	9.3	10.0	10.2	10.0	9.9	10.1
14[a]	48.1 N	178.1	10.0	10.3	10.2	10.0	9.8	9.9	9.3	9.5	9.7	9.7	9.9
14[b]	49.2 N	183.3	10.2	10.3	10.2	10.3	10.2	9.9	9.5	9.6	9.5	9.5	9.5
15	50.5 N	187.2	9.5	9.8	9.8	9.8	9.9	10.1	10.1	9.7	9.3	9.2	9.3
16	51.4 N	192.7	9.8	10.1	10.1	10.1	10.0	10.0	9.9	9.7	9.8	10.2	10.3
17	52.4 N	198.2	9.9	9.7	9.6	9.3	9.3	9.4	9.4	9.4	9.4	9.6	9.8
18	52.6 N	204.4	9.6	9.6	9.9	9.8	9.4	9.5	9.6	9.4	9.4	9.5	9.8
19	52.0 N	209.6	10.8	11.0	11.1	11.1	11.1	11.1	11.2	11.0	11.0	10.9	10.8
20	50.2 N	213.9	11.2	11.2	11.2	11.3	11.3	11.2	11.2	11.2	11.2	11.2	11.3
21	48.0 N	217.3	11.2	11.3	11.4	11.7	11.6	11.2	11.2	11.2	11.3	11.2	11.2
22	46.0 N	220.3	11.3	11.4	11.3	11.6	11.2	11.3	11.1	11.3	11.4	11.3	12.0
23	44.3 N	222.4	11.8	12.3	12.1	12.2	11.6	11.3	12.1	12.2	12.3	12.1	12.3
24	42.6 N	224.8	14.2	14.1	13.2	14.0	14.0	13.7	14.0	14.2	14.4	14.2	14.8
25	40.7 N	227.7	15.9	16.1	16.2	16.2	16.4	16.4	16.5	16.9	17.1	16.8	16.6
26	39.6 N	230.5	16.0	15.9	15.6	15.8	16.2	15.6	16.2	16.2	16.3	16.5	16.7
27	38.8 N	234.3	16.2	16.1	16.1	16.0	16.2	16.1	16.2	16.3	16.3	16.4	16.5
28	38.2 N	237.2	13.2	13.0	12.9	13.1	12.2	12.5	12.4	12.4	12.6	12.2	13.3
Sep. 4	37.0 N	236.3	14.3	14.5	14.9	15.7	15.8	15.8	15.6	15.3	14.7	14.2	14.2
5	35.5 N	235.0	16.5	16.7	16.8	16.8	16.9	17.2	16.9	17.1	17.3	17.4	17.7
6	33.8 N	233.7	17.6	17.8	17.7	17.8	17.8	17.9	17.8	17.7	17.8	18.1	18.3
7	32.4 N	232.1	18.1	17.4	17.8	17.9	17.9	17.8	18.7	18.8	18.9	19.7	20.1
8	31.6 N	231.2	19.8	19.9	19.8	19.8	19.8	19.8	19.9	19.8	19.9	19.5	19.8
9	30.4 N	229.0	20.8	20.8	20.8	20.8	20.8	20.8	20.7	20.8	21.1	21.3	21.4
10	29.3 N	227.4	20.8	20.9	21.0	20.9	21.0	20.9	20.9	21.1	21.8	21.9	22.5
11	28.2 N	225.7	21.8	21.8	21.8	21.8	22.0	22.0	22.0	22.1	21.9	22.7	23.2
12	27.7 N	224.6	22.4	22.3	22.2	22.1	22.5	22.3	22.3	22.4	22.7	22.8	23.3
13	27.0 N	222.3	22.8	22.7	22.6	22.6	22.8	22.6	22.6	22.8	23.0	23.1	23.2
14	26.7 N	220.9	23.0	22.9	22.9	20.9	21.9	22.5	22.9	23.3	23.6	23.8	22.9
15	26.5 N	219.4	23.6	23.6	23.5	23.3	23.1	23.0	23.1	23.5	23.4	23.2	23.6
16	26.2 N	217.9	24.0	23.9	23.9	24.0	24.0	24.0	24.0	24.0	24.2	24.4	24.6
17	25.1 N	216.4	23.9	23.9	23.9	24.1	24.1	24.1	24.1	24.7	25.1	25.9	26.4
18	24.0 N	214.4	23.5	24.0	24.7	24.7	24.8	24.7	24.6	25.0	25.5	25.0	25.2
19	23.4 N	211.3	24.8	24.8	24.8	24.8	24.8	24.8	24.8	25.1	25.7	25.8	25.9
20	22.9 N	208.6	24.8	25.3	25.4	25.6	25.6	25.6	25.6	25.8	26.2	26.0	26.3
21	22.3 N	206.4	26.2	26.0	25.9	25.5	25.5	25.5	24.9	26.4	26.9	27.4	27.0
22	21.7 N	204.3	26.1	26.1	26.2	25.8	25.7	25.7	25.8	26.7	26.7	26.7	26.8
23	21.3 N	202.1	26.2	26.1	26.1	26.1	26.1	26.0	25.9	26.5	26.8	27.8	28.3
Oct. 3	23.5 N	200.4	24.9	25.2	25.7	25.7	25.6	25.8	25.8	25.9	26.5	26.8	26.9
4	26.4 N	199.5	25.8	25.7	25.7	25.8	25.8	25.8	25.8	25.8	26.1	26.7	26.8
5	29.1 N	198.8	24.7	24.7	24.8	24.8	24.8	24.6	24.6	24.8	25.1	25.6	25.8
6	31.7 N	199.0	24.7	24.8	24.6	24.3	24.3	24.2	24.1	24.4	24.7	24.8	24.9
7	32.8 N	199.3	23.9	23.8	24.0	23.8	23.6	23.4	23.2	23.9	24.8	25.3	25.9
10	33.6 N	205.5	20.4	20.4	20.5	20.5	20.6	20.4	20.3	20.2	20.3	20.5	21.0
11	33.7 N	208.3	22.8	22.8	22.8	22.6	23.0	23.0	23.3	23.7	23.6	22.6	23.5
12	33.3 N	212.3	22.8	22.8	22.8	23.0	23.0	23.0	23.1	22.8	21.6	20.9	21.0
13	33.4 N	214.6	20.5	20.5	19.5	19.5	19.8	19.4	19.6	19.4	19.6	19.8	19.9
14	33.6 N	216.9	20.4	20.6	20.7	20.7	21.0	21.1	21.4	21.7	22.3	22.6	22.3
15	31.8 N	219.3	22.0	21.9	21.9	21.9	22.0	22.0	22.0	22.1	22.1	22.6	22.6
16	29.1 N	220.8	20.9	21.0	21.1	20.8	20.7	20.8	20.2	20.2	20.6	21.6	21.6
17	27.4 N	221.9	22.6	22.6	22.6	22.6	22.6	22.5	22.4	22.8	22.9	23.1	23.2
19	25.0 N	222.2	21.9	22.0	20.9	21.0	21.8	22.0	21.3	21.5	22.7	23.3	23.2
20	23.2 N	221.7	21.7	21.3	21.8	21.8	21.7	22.2	22.2	22.5	23.1	23.3	23.4
21	21.2 N	221.5	23.0	23.0	23.0	23.0	23.0	23.0	22.8	23.0	23.1	23.3	23.4

temperature, Carnegie, 1928-29--Continued

local mean hours													Mean
11	12	13	14	15	16	17	18	19	20	21	22	23	
													°C
16.2	17.1	17.2	17.1	17.2	16.3	16.2	15.9	15.9	16.1	16.1	16.0	16.0	17.23
23.6	23.1	23.1	23.3	23.6	23.3	23.6	23.4	23.1	23.0	22.3	22.6	22.3	22.69
22.0	22.0	22.0	21.9	21.3	21.8	21.7	20.9	20.1	19.7	19.3	19.3	19.8	20.81
21.1	21.9	21.8	21.3	22.0	22.1	22.3	21.5	21.1	21.0	20.9	20.6	20.8	20.63
20.1	19.4	19.1	20.3	19.9	19.4	20.0	19.9	19.4	19.1	19.1	18.9	18.7	19.85
18.5	18.3	18.0	18.0	18.0	18.0	18.0	18.1	18.2	18.0	18.1	18.2	18.6	18.11
19.4	19.4	18.7	18.5	18.1	17.9	17.1	16.8	16.7	16.9	16.9	17.0	17.4	17.77
18.2	17.8	17.9	17.7	17.4	16.9	16.6	16.7	16.6	16.4	16.1	15.9	15.8	16.87
16.0	16.0	15.9	15.9	15.9	16.1	16.0	15.7	15.4	15.4	15.5	15.6	15.7	15.85
14.9	14.4	14.2	14.3	14.2	14.2	14.3	14.3	14.1	13.8	13.4	13.5	13.9	14.35
11.5	11.6	12.0	12.0	12.0	12.0	11.6	11.3	11.3	11.5	11.3	11.3	11.5	12.00
11.1	10.9	11.0	11.2	11.0	10.8	10.6	10.5	10.3	10.4	10.7	10.6	10.9	10.80
10.3	10.3	10.4	10.3	10.4	10.7	10.9	10.5	10.2	10.1	10.2	10.1	10.0	10.30
9.1	9.3	9.2	9.2	9.4	9.3	9.1	9.1	9.1	9.0	9.3	9.3	9.3	9.30
9.0	8.5	8.8	8.6	7.6	7.2	6.9	6.8	6.3	6.3	6.5	6.9	7.2	8.13
7.6	8.0	8.0	8.1	7.6	7.5	7.4	7.3	7.2	7.2	7.3	7.3	7.5	7.42
7.8	8.0	8.2	8.1	7.9	8.1	8.1	8.1	8.0	8.0	7.9	7.7	7.7	7.73
7.5	7.9	8.0	7.8	8.0	8.2	8.2	8.1	8.0	8.1	8.2	8.3	8.6	7.78
9.5	9.5	9.9	9.9	10.0	9.9	9.9	9.5	9.3	9.2	9.2	9.2	9.3	9.40
10.2	11.0	10.5	11.0	10.5	10.2	10.2	10.2	10.2	10.2	10.3	10.3	10.3	10.07
10.0	10.2	10.2	10.1	9.9	9.8	9.8	9.7	9.8	9.9	9.9	9.9	10.0	9.90
9.9	9.5	9.4	9.4	9.6	9.5	9.4	9.3	9.3	9.2	9.2	9.2	9.2	9.62
9.8	10.2	10.0	10.1	10.1	9.7	9.3	9.3	9.4	9.5	9.6	9.8	9.9	9.72
10.2	10.1	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.10
10.0	10.3	11.0	10.9	10.9	10.6	10.3	10.0	9.9	9.8	9.4	9.3	9.3	9.85
10.1	10.2	10.4	10.5	10.4	10.4	10.2	10.2	10.3	10.4	10.5	10.6	10.7	10.02
10.9	11.0	11.2	11.2	11.2	11.2	11.2	11.0	11.0	11.0	11.1	11.1	11.1	11.05
11.3	11.5	12.1	12.1	11.7	11.5	11.3	11.3	11.3	11.3	11.2	11.2	11.2	11.35
11.6	12.1	12.1	12.2	12.6	12.5	12.0	11.6	11.3	11.5	11.3	11.1	11.2	11.57
12.3	12.7	12.5	12.6	12.8	12.4	12.4	12.5	12.5	12.4	11.6	11.5	12.1	11.90
12.3	12.5	13.2	14.0	13.9	14.1	14.2	14.1	13.6	13.3	13.5	13.8	14.0	12.87
14.8	15.5	15.3	15.0	15.4	15.4	15.2	15.2	14.9	15.2	15.3	15.5	15.6	14.71
16.9	16.9	17.3	17.5	17.6	17.4	17.4	17.3	17.0	17.1	16.9	16.6	16.3	16.80
16.6	17.1	17.2	17.2	17.1	17.1	17.0	17.0	16.9	17.0	16.8	16.5	16.4	16.54
16.6	16.8	16.7	16.7	16.6	16.5	16.4	16.5	16.2	14.6	14.2	13.7	13.3	15.97
13.2	13.5	14.1	14.7	15.9	15.0	15.2	15.2	15.2	15.3	15.2	15.0	14.9	13.80
14.7	14.9	15.0	15.7	16.4	16.3	16.7	16.8	16.5	16.3	16.3	16.3	16.4	15.55
17.8	18.1	18.2	18.6	18.7	18.8	18.1	17.9	17.8	17.8	17.9	18.0	17.6	17.61
18.9	18.8	18.8	18.8	18.7	18.4	19.1	18.8	18.8	18.7	18.9	18.5	18.6	18.34
20.9	19.9	20.1	20.7	20.7	20.8	20.7	19.8	19.8	19.8	19.8	19.8	19.9	19.41
20.9	20.8	21.2	21.6	21.6	21.8	21.1	20.8	20.8	20.8	20.7	20.8	20.8	20.48
21.6	21.8	21.7	21.6	21.9	22.0	21.9	21.4	20.9	20.8	20.8	20.8	20.8	21.17
21.9	22.6	22.7	22.5	22.7	22.8	21.8	21.8	21.4	21.4	21.5	21.8	21.8	21.68
23.5	23.8	24.2	23.5	23.8	23.2	23.4	22.7	22.7	22.4	22.4	22.4	22.4	22.65
23.8	23.7	23.6	23.8	24.0	23.9	23.9	23.6	22.9	22.9	22.8	22.8	22.8	22.99
23.5	23.6	24.6	25.8	24.8	24.4	24.7	23.8	23.6	23.3	23.1	23.2	23.2	23.43
23.7	23.5	23.6	24.7	24.9	24.9	23.8	23.6	23.4	23.4	23.5	23.5	23.6	23.36
23.8	24.0	23.9	24.0	24.2	24.2	24.3	24.1	23.9	23.9	24.0	24.0	24.0	23.72
24.7	24.9	24.6	25.0	24.6	24.5	24.3	24.2	24.0	24.0	24.1	24.1	24.0	24.25
26.3	26.8	27.0	26.0	25.5	24.9	24.8	24.8	24.7	24.7	24.6	24.6	24.6	24.98
25.1	25.1	25.5	25.7	25.3	25.0	25.0	24.9	24.9	24.9	25.0	24.9	24.9	24.91
26.3	26.5	26.1	26.1	26.2	25.9	25.8	25.7	25.7	25.6	25.5	25.5	24.8	25.49
26.6	26.7	26.7	26.6	26.2	26.7	26.2	26.0	25.9	25.9	25.9	26.2	26.3	26.00
25.7	26.8	27.1	27.3	26.6	26.6	26.7	26.1	26.1	25.9	26.3	26.2	26.3	26.29
27.6	27.4	28.2	28.1	27.7	26.7	26.3	26.0	26.1	26.1	26.2	25.7	25.9	26.51
28.1	28.7	29.7	30.4	31.1	30.5	30.6	29.2	29.3	29.0	26.8	27.3	26.8	27.89
26.8	27.2	27.5	27.4	26.9	25.7	26.4	26.2	26.2	26.2	26.1	25.9	25.8	26.21
26.8	27.1	26.8	26.6	26.6	25.9	25.8	25.2	25.0	25.0	24.9	24.9	24.7	25.88
25.8	26.2	26.1	25.8	25.6	24.2	24.1	23.8	23.8	23.9	24.4	24.7	24.7	24.89
25.3	25.8	25.2	25.0	24.9	24.8	24.7	24.2	24.0	24.1	24.1	24.0	23.9	24.58
26.5	25.4	24.6	24.6	24.3	24.0	23.8	23.1	22.8	22.8	22.6	22.5	22.5	23.96
21.5	21.7	22.8	23.5	23.2	22.8	22.1	21.8	21.8	21.9	22.3	21.5	22.4	21.43
23.5	23.6	24.8	24.8	24.7	24.7	23.8	21.9	22.3	22.7	22.7	22.6	22.8	23.28
21.1	20.5	20.2	19.8	19.9	20.7	20.9	21.4	21.7	21.8	20.3	20.4	20.5	21.50
20.0	20.6	21.2	21.4	21.6	20.8	20.4	20.0	20.0	20.1	20.2	20.4	20.4	20.19
22.5	22.8	21.9	21.9	22.1	21.9	21.8	21.8	21.8	21.8	21.9	21.9	22.1	21.71
20.8	20.8	20.0	20.5	20.6	19.2	19.8	20.3	20.8	20.8	20.8	20.8	20.9	21.22
21.8	21.8	21.8	21.8	21.7	21.8	21.6	20.9	21.2	21.5	21.6	21.9	22.4	21.30
23.2	24.2	24.4	24.5	25.6	25.9	25.2	23.1	22.7	22.0	21.9	21.9	21.9	23.18
23.4	22.4	22.1	22.0	22.1	22.0	22.3	22.2	22.2	22.0	22.0	22.0	22.0	22.10
23.8	23.7	23.3	23.2	23.1	23.2	23.3	23.1	23.1	23.1	23.1	23.1	23.1	22.80
23.2	23.4	23.1	23.1	23.0	22.9	22.9	22.8	22.9	23.0	23.1	23.2	23.3	23.06

Table 78. Hourly values of air

Date	Latitude	Longitude east	Values in °C, 00	01	02	03	04	05	06	07	08	09	10
1929	°	°											
Oct. 22	18.3 N	222.0	23.4	23.4	23.4	23.4	23.7	23.3	23.3	23.6	24.0	24.4	24.4
23	16.2 N	223.0	24.6	24.6	24.8	24.8	24.9	24.9	25.0	25.1	25.2	25.2	25.6
24	13.6 N	223.5	25.7	24.4	24.8	24.6	24.3	24.2	24.5	24.4	25.0	25.2	26.0
25	12.7 N	222.5	25.0	24.8	23.8	24.3	24.3	24.6	25.0	24.8	24.4	24.0	24.0
26	11.3 N	221.3	24.8	24.9	25.1	25.2	25.6	25.5	25.6	26.0	26.5	27.2	27.6
27	10.1 N	220.3	26.0	26.1	26.1	26.1	26.0	26.1	26.1	26.8	27.4	28.1	28.2
28	8.6 N	219.2	26.2	25.8	25.8	26.2	26.2	25.9	26.1	26.2	27.5	28.0	28.1
29	7.7 N	218.6	26.9	26.9	26.9	26.0	26.0	26.0	26.2	25.9	27.1	27.1	27.5
30	7.1 N	217.4	26.3	26.7	26.2	26.3	26.6	26.6	26.8	27.0	27.5	28.1	27.8
31	6.7 N	216.6	24.2	24.0	24.4	25.0	24.9	25.2	25.0	25.6	26.2	27.0	27.1
Nov. 1	5.8 N	215.3	26.4	26.8	26.9	27.1	27.2	26.0	26.1	26.1	25.7	25.8	25.6
2	4.9 N	213.2	27.8	27.7	27.6	27.6	27.3	27.1	26.8	27.1	27.3	27.2	27.2
3	4.3 N	210.7	26.3	26.1	26.0	26.3	26.2	26.1	26.1	26.3	26.4	26.7	26.8
4	3.0 N	210.2	26.6	26.5	26.3	26.2	26.2	26.2	26.1	26.3	26.7	26.8	26.9
5	0.8 N	208.5	26.5	26.4	26.5	26.2	26.1	26.0	26.0	26.1	26.7	26.9	27.0
6	1.8 S	207.6	26.7	26.5	26.5	26.6	26.6	26.5	26.6	26.9	27.3	28.0	28.0
7	4.9 S	206.6	27.0	26.9	26.9	26.9	26.8	26.8	26.8	27.1	27.8	28.3	28.4
8	6.6 S	204.9	27.0	27.0	27.0	26.9	26.9	26.9	26.9	27.5	27.7	27.6	27.7
9	8.1 S	203.1	27.5	27.5	27.5	27.5	27.5	27.5	27.6	28.1	29.1	29.4	29.7
10	9.0 S	201.9	28.0	27.9	27.9	27.7	27.6	27.6	27.7	28.0	28.7	28.6	28.2
11	9.4 N	200.9	27.6	27.7	27.7	27.8	27.7	27.7	27.8	28.0	28.8	28.8	29.1
12	10.3 N	198.9	28.0	28.0	28.0	28.0	27.9	28.0	28.0	27.7	28.0	29.0	29.5
13	11.0 N	198.0	28.0	27.9	28.0	27.9	27.9	27.9	26.9	25.0	25.7	26.1	27.8
14	11.6 N	196.6	27.5	27.6	27.7	27.5	27.3	27.4	27.5	28.5	29.5	29.9	30.9

temperature, Carnegie, 1928-29--Concluded

local mean hours													Mean
11	12	13	14	15	16	17	18	19	20	21	22	23	
													°C
24.2	24.1	24.1	24.1	24.0	24.0	24.0	24.0	24.0	24.2	24.3	24.3	24.3	23.91
25.3	25.2	25.2	25.1	25.0	25.1	25.1	25.1	25.2	25.2	25.3	25.3	25.7	25.10
26.1	25.8	26.0	26.5	26.2	26.4	26.3	26.3	25.9	25.7	25.8	25.4	25.8	25.47
24.4	24.8	23.2	23.0	23.7	23.6	23.5	23.6	23.9	24.1	24.4	24.6	24.9	24.20
27.6	28.0	28.5	28.8	28.3	27.6	26.1	26.0	26.0	26.0	26.1	26.1	26.1	26.47
28.7	28.8	28.2	28.0	28.8	29.6	27.4	25.4	26.0	26.0	26.2	26.2	26.3	27.03
28.1	28.6	28.9	28.3	27.9	26.1	26.8	25.8	25.9	26.1	26.3	26.5	26.8	26.84
27.5	28.0	27.1	28.1	27.5	27.2	27.3	27.2	27.1	27.2	27.3	27.1	26.0	26.96
26.9	27.2	26.1	26.5	26.5	26.2	26.7	26.6	25.5	24.8	24.0	24.2	24.1	26.30
27.2	27.4	26.1	26.3	26.8	26.9	27.0	27.0	27.1	27.1	27.1	26.5	26.9	26.17
25.9	26.9	25.9	25.9	26.2	27.2	27.5	27.5	27.6	27.5	27.6	27.8	27.8	26.71
27.1	27.2	27.2	27.2	27.1	27.1	27.0	27.0	26.9	26.9	26.8	26.8	26.5	27.15
27.0	27.0	27.0	27.6	27.6	27.6	27.3	27.1	27.0	26.8	26.8	26.7	26.7	26.73
26.9	26.8	27.1	27.0	27.0	26.9	26.8	26.9	26.9	26.9	26.8	26.7	26.6	26.67
26.9	27.0	26.9	26.7	26.6	26.6	26.6	26.5	26.6	26.6	26.7	26.7	26.7	26.56
27.9	27.9	27.7	27.3	27.1	27.2	26.7	26.9	27.0	27.0	27.0	27.0	27.0	27.08
28.7	28.5	28.8	28.0	27.4	27.7	27.7	27.5	27.3	27.4	27.3	27.3	27.1	27.52
28.0	27.9	27.9	27.9	27.9	27.8	27.8	27.7	27.6	27.6	27.6	27.5	27.5	27.49
29.4	29.6	29.9	29.9	29.8	29.0	28.5	28.2	28.1	28.0	28.0	28.0	28.0	28.47
28.0	28.0	28.1	28.2	28.8	28.1	28.0	27.9	27.7	27.7	27.7	27.7	27.7	27.98
29.2	29.0	29.0	29.2	29.0	28.9	28.2	28.0	28.0	27.9	27.9	27.9	28.0	28.29
29.4	29.4	29.0	29.0	28.9	28.9	29.0	28.6	28.4	28.2	28.1	28.2	28.1	28.47
28.7	28.9	29.1	29.1	29.0	28.9	28.6	28.0	27.9	27.9	27.9	27.8	27.7	27.86
31.9	31.9	32.5	31.9	31.2	30.6	29.7	28.9	28.4	28.1	27.9	27.8	27.7	29.16

Table 79. Hourly values of sea-surface

Values are thermogram readings

Date	Latitude	Longitude east	Values in °C, 00	01	02	03	04	05	06	07	08	09	10
1928	°	°											
May 18	39.2 N	314.4	18.4	20.0	20.3	20.0	20.2	19.9	20.2	20.4	20.4	20.4	20.6
19	40.6 N	318.2	17.5	17.9	17.2	16.0	15.9	15.6	15.9	16.0	16.0	16.2	16.2
20	42.0 N	321.2	16.1	15.9	16.0	16.1	16.0	15.9	15.6	15.7	15.4	15.5	15.2
21	44.0 N	324.0	14.9	15.0	14.7	14.7	14.8	14.9	14.6	15.0	15.1	15.2	15.3
22[a]	45.5 N	326.7	15.5	15.6	15.9	15.5	15.9	15.0	14.4	14.8	14.9	14.4	14.0
23	45.0 N	326.9	15.5	15.5	15.6	15.1	15.1	15.0	15.0	14.9	14.6	14.6	14.6
24	43.9 N	328.4	15.2	15.4	15.5	15.6	15.3	15.1	15.8	16.0	16.1	16.1	16.0
25	43.2 N	328.6	15.2	15.2	15.0	15.0	15.0	15.0	14.9	14.9	15.0	15.0	15.3
26[b]	44.0 N	331.6	15.6	15.5	15.5	15.0	14.8	14.8	14.8	14.9	15.3	14.3	14.3
27	45.8 N	334.5	13.9	13.9	13.9	13.8	13.9	13.9	13.9	13.7	13.6	13.6	13.8
28	48.2 N	338.9	13.4	13.4	13.4	13.4	13.3	13.1	12.9	13.0	13.5	13.2	13.1
29	48.8 N	341.2	12.6	12.5	12.5	12.8	12.6	12.5	12.5	12.6	12.9	12.9	13.0
June 1	50.0 N	346.9	12.5	12.5	12.4	12.4	12.4	12.4	12.4	12.4	12.5	12.6	12.6
2	49.5 N	348.0	13.2	12.8	13.6	13.1	13.1	13.1	13.2	13.2	13.2	13.1	13.2
3	50.2 N	347.4	12.9	12.8	12.7	12.7	12.6	12.6	12.6	12.7	12.7	12.6	12.5
4	50.5 N	347.7	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.4	12.4	12.5	12.7
5	49.9 N	348.9	12.5	12.6	12.6	12.5	12.7	12.7	12.7	12.6	12.6	12.6	12.8
6	50.2 N	350.0	12.7	12.6	12.6	12.8	12.8	12.8	12.9	12.7	12.6	12.7	12.9
7	50.2 N	352.0	12.9	12.9	12.6	12.6	12.7	12.6	12.6	12.7	12.8	12.8	12.9
8[c]	50.0 N	354.9	13.1	13.1	13.1	13.1	12.9	12.9	12.8	12.9	13.1	12.4	12.3
19	50.5 N	359.0	12.4	12.3	12.3	12.3	12.3	12.3	12.3	12.3	12.4	12.5	12.8
20	51.7 N	2.3	12.6	12.4	12.4	12.8	12.8	12.6	12.6	12.6	12.5	12.6	12.9
21[c]	53.4 N	4.4	12.3	12.3	12.3	12.4	12.3	12.3	12.4	12.5	12.5	12.5	12.6
July 8[d]	54.1 N	7.6	15.5	15.4	15.2	15.3	15.1	15.0	14.6	14.5	13.9	13.5	13.5
11	60.5 N	0.3	11.3	11.3	11.2	11.2	11.2	11.2	11.2	11.2	11.1	10.8	10.8
12	62.3 N	355.0	10.4	10.4	10.4	10.4	10.4	10.4	9.5	9.5	9.6	9.7	9.7
13	63.3 N	350.6	9.7	9.9	10.0	9.6	9.5	9.5	9.7	9.6	9.8	10.0	9.7
14[e]	64.1 N	348.6	9.3	9.4	9.4	9.1	8.9	8.0	6.9	8.4	9.1	9.3	9.5
15[f]	63.5 N	345.2	9.9	9.9	9.9	9.9	10.1	10.2	10.2	10.2	10.6	10.8	10.9
16	63.3 N	342.6	10.6	10.6	10.5	10.6	10.6	10.5	10.7	11.0	11.4	11.5	11.3
17	63.0 N	341.4	11.2	11.2	11.2	10.8	11.2	11.3	11.3	11.2	11.3	11.5	11.6
18	62.6 N	340.0	11.7	11.8	11.7	11.7	11.7	11.7	11.8	11.8	11.7	11.7	11.7
19[g]	63.6 N	338.0	11.9	12.2	12.3	12.3	12.1	12.1	11.9	11.9	12.0	12.3	12.2
28[c]	62.5 N	333.7	10.5	11.1	11.3	11.4	11.4	11.2	11.0	11.1	11.2	11.1	11.1
29	60.7 N	328.8	11.5	11.5	11.5	11.4	11.4	11.4	11.0	11.3	11.4	11.2	11.5
30	59.3 N	325.8	10.8	10.8	11.1	11.0	11.0	11.1	11.2	11.2	11.0	11.1	11.1
31	57.9 N	325.6	11.0	11.0	10.8	10.9	11.1	11.1	11.1	10.9	10.9	10.9	11.3
Aug. 1	58.3 N	324.2	10.5	10.9	10.8	10.8	11.1	10.6	10.5	10.5	10.5	10.6	10.3
2	58.3 N	321.3	10.9	11.1	11.1	11.0	11.0	11.0	11.0	10.8	10.9	10.9	11.0
3	57.9 N	314.5	9.1	9.1	9.1	9.2	9.1	9.0	9.0	9.0	8.9	9.0	9.2
4	54.5 N	311.0	8.9	9.3	9.6	9.7	9.9	9.7	10.0	9.8	9.1	9.6	9.9
5	51.6 N	310.4	10.2	10.0	9.7	9.6	8.8	8.7	9.1	8.7	8.5	8.5	8.5
6	48.4 N	311.8	10.1	10.0	10.5	10.5	10.6	10.6	10.5	10.4	10.9	11.0	11.4
7[h]	45.9 N	312.1	11.5	12.1	12.2	12.3	12.3	11.9	11.7	11.3	10.8	11.3	11.2
8	43.2 N	313.0	17.7	17.5	17.5	17.1	16.7	16.1	16.7	16.5	16.5	15.7	15.1
9	42.2 N	312.7	20.8	21.0	21.1	21.3	21.3	21.3	21.3	21.1	21.1	21.1	21.6
10[i]	39.8 N	311.1	21.7	22.1	21.9	21.8	21.6	22.1	21.6	23.8	24.6	24.2	24.6
11	38.6 N	311.2	24.9	24.6	24.6	24.7	24.7	24.6	24.6	24.6	24.6	24.7	24.8
12	37.0 N	311.6	25.6	25.6	25.5	25.2	25.1	25.1	25.2	25.3	25.4	25.6	25.7
13	36.8 N	313.4	26.1	25.9	26.0	25.7	25.2	25.3	25.7	25.7	25.8	25.9	26.0
14	35.2 N	315.6	26.0	26.0	26.0	26.1	26.2	26.2	26.2	26.2	26.2	26.1	25.8
15	33.6 N	317.7	26.6	26.4	26.4	26.3	26.4	26.3	26.4	26.5	26.4	26.4	26.4
16	31.2 N	318.8	26.4	26.3	26.3	26.7	26.8	26.7	26.7	26.7	26.7	26.8	27.2
17	29.8 N	319.4	27.2	27.2	27.1	27.1	26.9	27.0	26.7	26.8	26.8	26.8	26.9
18	27.9 N	320.5	27.0	27.0	26.9	27.1	26.9	26.7	27.0	27.0	27.0	26.9	27.0
19	25.7 N	321.0	26.8	26.8	26.9	26.9	26.8	26.8	26.8	26.8	26.5	26.8	26.9
20	24.0 N	320.4	26.7	26.8	26.8	26.6	26.7	26.7	26.5	26.5	26.5	26.6	26.8
21	21.8 N	320.4	26.8	26.5	26.5	26.5	26.5	26.5	26.4	26.4	26.5	26.5	26.5
22	19.2 N	321.5	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	25.9	26.0
23	16.6 N	322.2	26.0	26.0	26.1	26.1	26.0	26.1	26.0	26.1	26.1	26.1	26.2
24[j]	15.8 N	322.1	26.3	26.2	26.2	26.2	26.2	26.2	26.2	26.3	26.5	26.6	27.0
27	13.4 N	322.0	26.9	26.7	26.7	26.7	26.6	26.7	26.6	26.6	26.6	26.7	27.0
28	11.9 N	322.2	27.0	26.9	27.0	27.2	27.2	27.2	27.2	27.2	27.2	27.3	27.7
29	10.8 N	322.6	27.2	27.4	27.2	27.2	27.2	27.2	27.2	27.2	27.2	27.2	27.3

[a] Small, rapid fluctuations in surface temperature morning hours; cloudy, moderate breeze. [b] Small, rapid fluctuations in surface temperature between 13h and 20h; cloudy, fresh. [c] Carnegie at Plymouth June 9-18; at Hamburg June 22-July 7; at Reykjavik July 20-27. [d] Gradual fall of 2°3 between 00h and 17h; leaving Helgoland. [e] Sharp fall and rise of 2° between 04h and 08h. Another sudden fall and rise of 1°5 between 14h and 17h; squalls during day. [f] Small, rapid fluctuations between 11h and 24h; partly cloudy

temperature, Carnegie, 1928-29

corrected from bucket readings

local mean hour													Mean
11	12	13	14	15	16	17	18	19	20	21	22	23	
													°C
20.7	20.8	20.8	20.5	20.3	19.9	18.0	18.3	18.6	19.0	18.2	17.5	17.7	19.63
16.3	16.3	15.9	16.1	16.1	16.6	17.3	16.9	16.9	16.3	16.3	16.4	16.3	16.42
15.5	15.6	15.5	16.1	16.4	16.6	16.5	16.2	16.2	16.1	15.9	15.9	15.1	15.88
15.4	15.4	15.5	15.5	15.2	15.0	15.3	15.2	15.1	15.1	15.1	15.0	15.0	15.08
15.2	15.3	15.2	15.1	15.7	15.8	15.6	15.4	15.4	15.7	15.6	15.6	15.6	15.30
14.6	14.6	14.6	13.8	14.1	14.1	14.1	14.3	14.1	14.1	15.1	15.1	15.1	14.72
16.2	16.1	15.9	15.6	15.2	15.2	15.2	15.2	15.2	15.2	15.2	15.2	15.2	15.53
15.3	15.3	15.9	15.8	15.8	15.8	15.8	15.8	15.7	15.7	15.8	15.8	15.7	15.40
14.6	15.4	15.0	14.5	14.4	15.0	14.8	14.9	13.9	14.3	14.3	14.0	13.9	14.74
13.8	13.8	13.8	13.9	13.9	13.7	13.9	14.0	13.6	13.5	13.5	13.5	13.5	13.76
13.2	13.4	13.2	13.1	12.9	12.9	12.9	12.8	12.8	12.7	12.7	12.7	12.6	13.07
13.0	13.2	13.4	13.4	13.4	13.4	13.4	13.3	13.2	12.9	12.8	12.8	12.7	12.93
12.6	12.6	12.6	12.6	12.8	12.8	13.0	13.1	13.1	13.1	12.9	13.0	13.0	12.68
13.2	13.3	13.2	13.3	13.3	13.3	13.3	13.2	13.0	13.0	12.9	12.8	12.8	13.14
12.6	12.6	12.6	12.6	12.6	12.5	12.5	12.4	12.4	12.4	12.4	12.4	12.4	12.58
12.7	12.9	12.9	12.9	12.9	12.9	13.0	13.1	13.0	13.0	13.1	12.9	12.6	12.73
12.4	12.4	12.4	12.4	12.4	12.4	12.5	12.5	12.5	12.4	12.6	12.6	12.7	12.55
13.0	12.9	12.9	12.9	12.9	12.9	12.9	12.9	13.0	12.9	12.9	12.9	12.8	12.83
13.1	13.1	12.9	13.0	13.0	13.0	13.1	13.1	13.2	13.0	13.0	12.9	12.9	12.89
12.6	12.9	12.9	12.9	12.9	12.9	12.9	12.9	12.9	13.3	13.2	13.2	13.4	12.94
12.9	13.4	13.5	12.9	12.6	12.6	12.5	12.5	12.4	12.4	12.4	12.4	12.5	12.55
12.9	13.1	13.1	13.1	13.0	12.8	12.6	12.5	12.5	12.4	12.4	12.4	12.4	12.67
12.8	12.9	13.2	13.2	13.1	13.0	13.3	13.3	13.2	13.3	13.2	12.8	12.6	12.76
13.9	13.9	13.8	13.8	13.7	13.7	13.2	13.8	13.9	14.0	14.2	14.4	14.2	14.25
10.8	10.8	10.9	10.9	11.1	11.2	11.0	10.9	10.9	10.9	10.9	10.9	10.4	11.00
9.6	9.4	9.7	9.5	9.4	9.2	9.3	9.4	10.0	9.6	9.8	9.5	9.9	9.78
9.5	9.5	9.4	9.3	9.3	9.5	9.0	9.4	9.4	9.4	9.5	9.5	9.4	9.55
9.6	9.6	9.6	9.3	8.6	8.2	9.6	9.7	9.7	9.7	9.7	10.0	10.4	9.21
11.2	11.2	10.9	10.7	10.8	10.8	10.9	11.0	10.7	10.8	10.8	10.6	10.5	10.56
11.6	11.6	11.5	11.4	11.7	11.7	11.7	11.7	11.6	11.4	10.7	11.0	11.2	11.17
11.7	11.6	11.9	11.8	11.8	11.7	11.8	11.8	11.8	11.8	11.7	11.7	11.8	11.53
11.3	11.7	11.6	11.8	11.9	12.0	12.0	12.1	12.1	11.9	11.8	11.8	12.1	11.80
12.4	12.6	12.6	12.0	11.6	12.2	12.2	12.3	9.5	9.6	10.4	11.3	11.3	11.80
11.3	11.4	11.3	11.3	11.4	11.4	11.4	11.4	11.3	11.3	11.0	11.1	11.3	11.22
11.6	11.6	11.6	11.4	11.5	11.6	11.4	11.5	11.3	11.3	11.2	11.3	11.3	11.40
11.2	11.3	11.3	11.1	11.1	11.3	11.1	11.1	11.1	10.7	11.0	10.8	11.0	11.06
11.3	11.3	11.3	11.4	11.2	11.0	11.0	11.5	11.4	11.3	11.0	10.8	10.5	11.08
11.0	11.0	11.0	11.1	11.1	11.0	11.0	11.0	11.0	11.0	10.7	11.0	11.0	10.83
11.0	11.1	11.0	10.9	10.3	10.2	10.0	9.9	10.5	10.4	9.7	9.8	9.8	10.64
8.8	8.8	9.2	9.2	9.2	9.5	9.7	9.7	9.7	9.6	9.4	9.4	9.5	9.23
10.2	10.6	10.6	10.7	11.1	11.1	10.7	10.8	10.9	11.0	10.9	10.1	10.0	10.18
8.5	8.9	9.0	9.4	9.3	9.4	9.5	9.8	9.8	9.5	9.5	9.8	10.0	9.28
11.5	11.2	11.2	9.7	9.3	9.2	9.8	10.1	10.1	10.8	10.8	10.9	11.2	10.51
11.2	10.8	11.2	11.8	13.7	14.4	14.0	15.6	16.3	16.2	17.1	18.3	17.7	13.20
16.6	16.1	17.6	18.1	19.1	19.1	19.0	19.3	20.5	21.1	21.1	21.1	20.9	18.03
21.4	21.3	21.3	21.6	21.6	21.8	21.1	21.2	21.2	21.6	21.8	21.8	21.6	21.35
25.0	25.1	25.8	25.8	26.0	26.1	26.1	26.1	26.0	25.6	25.3	25.1	25.1	24.30
24.9	24.8	24.9	25.1	25.1	25.1	25.2	25.2	25.2	25.3	25.3	25.3	25.6	24.93
26.0	26.1	26.2	26.1	26.2	26.2	26.1	25.8	25.7	25.3	25.8	25.9	26.1	25.70
26.1	26.2	26.1	25.3	25.6	25.5	25.4	25.4	25.8	26.0	26.0	26.0	26.0	25.78
25.7	25.9	26.1	26.2	26.2	26.5	26.7	26.1	25.9	26.0	26.7	26.7	26.7	26.18
26.3	26.0	26.1	26.2	26.2	26.2	25.8	25.8	26.2	26.1	26.0	26.2	26.6	26.26
27.1	27.1	26.8	27.1	27.2	27.3	27.3	27.5	27.5	27.4	27.2	27.2	27.2	26.97
27.0	27.0	27.2	27.4	27.3	27.3	27.3	27.2	27.1	27.0	27.1	27.2	27.0	27.07
27.1	27.0	27.1	27.3	27.4	27.4	27.3	27.0	27.0	27.0	27.0	27.0	26.9	27.04
27.1	27.2	27.2	27.2	27.2	27.1	27.2	27.0	27.0	27.0	27.0	27.0	26.9	26.95
26.9	27.0	27.0	27.1	27.1	27.2	27.0	27.0	27.0	27.0	26.9	26.8	26.9	26.84
26.5	26.5	26.5	26.5	26.5	26.3	26.3	26.2	26.1	26.0	26.0	26.0	26.0	26.38
26.0	26.1	26.2	26.1	26.1	26.0	26.0	26.0	26.1	26.0	26.1	26.1	26.1	26.03
26.3	26.5	26.5	26.6	26.6	26.6	26.6	26.6	26.3	26.5	26.6	26.5	26.4	26.31
27.2	27.2	26.8	27.7	29.1	28.2	28.1	27.3	27.2	27.0	27.0	27.5	26.7	26.95
26.9	27.5	27.3	28.2	28.4	27.1	27.1	27.6	27.1	27.4	27.2	27.2	27.0	27.08
27.7	27.8	27.9	28.1	27.9	27.7	27.9	27.7	27.6	27.5	27.4	27.3	27.2	27.45
27.3	27.5	27.7	28.0	27.5	27.6	27.4	27.4	27.5	27.4	27.6	27.4	27.5	27.39

gentle breeze. [g] Sudden fall of 2°.8 between 18h and 19h; approaching Reykjavik. [h] Very irregular fluctuations with rise of 7°.5 between 12h and 20h; in boundary zone between Gulf Stream and Labrador Current; clear, moderate breeze. [i] Rapid rise in temperature of 3° with irregular fluctuations between 06h and 08h; entering Gulf Stream. [j] Small, rapid fluctuations in temperature between 10h and 18h; partly cloudy, calm to light airs.

Table 79. Hourly values of sea-surface

Date	Latitude	Longitude east	Values in °C, 00	01	02	03	04	05	06	07	08	09	10
1928	°	°											
Aug. 30	9.5 N	322.8	27.4	27.3	27.1	27.2	27.3	27.1	27.1	27.1	27.1	27.4	27.9
31	8.2 N	323.8	27.2	27.1	27.1	27.1	27.1	27.2	27.2	27.2	27.2	27.2	27.3
Sep. 1	9.4 N	323.3	27.1	27.2	27.2	27.2	27.2	27.2	27.2	27.2	27.2	27.2	27.2
2	9.8 N	323.3	27.1	27.1	27.0	27.0	26.9	26.9	26.9	27.1	27.2	27.3	27.5
3	11.2 N	322.9	27.5	27.6	27.6	27.4	27.3	27.3	27.3	27.3	27.3	27.5	27.6
4	11.4 N	322.0	27.2	27.2	27.1	27.1	27.1	27.2	27.1	27.3	27.5	27.5	27.6
5	11.6 N	319.2	27.3	27.6	27.6	27.6	27.6	27.5	27.5	27.6	27.6	27.6	27.7
6	11.7 N	317.4	27.6	27.7	27.7	27.7	27.8	27.7	27.7	27.8	27.8	27.8	28.2
7	11.3 N	315.8	27.6	27.5	27.4	27.6	27.4	27.4	27.4	27.4	27.6	27.7	27.8
8	11.6 N	314.9	27.7	27.7	27.7	27.7	27.7	27.7	27.7	27.7	27.7	27.8	27.9
9	11.8 N	313.9	28.1	28.0	28.2	27.8	28.0	27.8	27.8	27.9	27.9	28.0	28.0
10	12.2 N	312.2	28.0	28.1	28.2	28.2	28.1	28.0	27.9	27.7	27.7	27.7	27.7
11	13.2 N	310.3	27.6	27.5	27.4	27.5	27.5	27.5	27.5	27.5	27.5	27.4	27.5
12	13.2 N	309.5	27.6	27.6	27.6	27.5	27.6	27.6	27.6	27.6	27.6	27.8	27.9
13	13.3 N	307.6	27.7	27.7	27.7	27.7	27.7	27.6	27.6	27.6	27.6	27.6	27.6
14	13.0 N	305.7	27.6	27.6	27.6	27.6	27.6	27.6	27.6	27.6	27.6	27.9	27.9
15	12.9 N	303.7	27.7	27.8	27.8	27.8	27.8	27.8	27.8	27.8	27.9	27.9	28.0
16	13.0 N	301.5	27.6	27.8	27.9	28.0	28.0	27.9	28.0	28.0	28.1	28.1	28.2
Oct. 2[a]	14.7 N	298.6	28.1	28.1	28.2	28.1	28.1	28.1	28.2	28.2	28.3	28.2	28.6
3	14.8 N	296.4	28.2	28.2	28.1	28.4	28.6	28.5	28.4	28.6	28.6	28.6	28.6
4	15.0 N	293.9	28.2	28.1	28.5	28.4	28.4	28.4	28.4	28.5	28.5	28.6	28.6
5	15.3 N	291.8	28.6	28.6	28.6	28.6	28.4	28.3	28.2	28.1	28.2	28.2	28.1
6	15.2 N	288.8	28.4	28.7	28.7	28.6	28.4	28.4	28.3	28.4	28.5	28.5	28.5
7	14.5 N	286.0	28.5	28.5	28.5	28.5	28.5	28.5	28.6	28.5	28.6	28.6	28.7
8	13.2 N	283.6	28.0	28.2	28.2	28.1	28.2	28.5	28.6	28.7	28.7	28.6	28.6
9	11.4 N	281.4	28.1	28.2	28.2	28.2	28.2	28.3	28.3	28.2	28.4	28.3	28.5
10	10.3 N	280.7	28.5	28.4	28.5	28.3	28.5	28.6	28.5	28.6	28.7	28.7	28.6
26[a]	6.7 N	280.1	28.1	27.9	27.7	27.7	27.6	27.6	27.6	27.7	27.5	27.6	27.5
27	5.7 N	279.9	27.2	27.2	27.2	27.2	27.2	27.1	27.2	27.1	26.8	27.1	27.1
28	4.3 N	280.2	26.7	26.8	26.9	26.7	26.7	26.7	26.7	26.9	26.9	26.9	26.9
29	4.1 N	280.1	26.7	26.7	26.7	26.7	26.7	26.7	26.6	26.6	26.6	26.9	27.1
30	2.9 N	279.9	26.6	26.6	26.6	26.6	26.6	26.6	26.6	26.6	26.6	26.6	26.6
31	4.5 N	278.1	26.4	26.4	26.4	26.4	26.4	26.5	26.6	26.6	26.7	26.7	26.8
Nov. 1	6.1 N	277.0	26.7	26.9	26.8	26.9	27.1	27.0	27.1	27.2	27.2	27.2	27.2
2	4.6 N	277.7	27.0	27.1	27.0	26.9	26.9	26.9	26.9	26.9	27.1	27.1	27.1
3	3.7 N	278.5	26.6	26.6	26.5	26.5	26.6	26.7	26.6	26.4	26.5	26.4	26.4
4	2.5 N	278.9	26.2	26.2	26.1	26.1	26.2	26.2	26.2	26.1	26.4	26.4	26.3
5	1.6 N	279.2	26.1	26.0	26.1	25.9	26.0	26.0	26.0	26.2	26.2	26.2	26.1
6	0.8 N	278.8	25.7	25.6	25.4	25.4	25.3	25.2	25.0	25.1	25.0	25.0	25.0
7	0.5 S	278.0	24.7	24.7	24.6	24.4	24.4	24.3	23.9	23.8	23.7	23.2	23.2
8	1.5 S	277.7	23.2	23.2	23.2	23.2	23.1	23.0	22.7	22.5	22.2	22.2	22.2
9	1.3 S	275.2	19.3	19.2	19.1	19.1	19.1	19.2	19.2	19.4	19.3	19.3	19.4
10	1.6 S	273.0	19.4	19.4	19.6	19.7	19.7	19.8	20.1	20.3	20.5	20.5	20.6
11	1.9 S	271.0	21.7	21.7	21.7	21.7	21.6	21.2	21.0	21.0	21.0	21.1	21.1
12[b]	1.3 S	268.7	19.4	19.5	19.5	19.5	19.3	19.1	18.9	19.0	19.2	19.3	19.3
13[c]	1.5 S	266.9	17.6	17.4	17.3	17.7	17.8	18.2	18.8	18.8	18.8	18.8	18.8
14	1.8 S	265.7	19.0	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.9
15	2.5 S	264.2	19.4	19.3	19.6	19.3	19.3	19.3	19.5	19.5	19.6	19.7	19.8
16	3.1 S	261.8	20.3	20.3	20.3	20.3	20.3	20.3	20.6	20.5	20.6	20.6	20.7
17	3.3 S	260.2	20.7	20.7	20.7	20.7	20.7	20.7	20.7	20.7	20.8	20.8	20.8
18	4.0 S	257.4	21.3	21.2	21.2	21.2	21.1	21.1	21.2	21.3	21.3	21.3	21.4
19	4.6 S	254.9	22.4	22.4	22.4	22.4	22.4	22.4	22.6	22.6	22.6	22.6	22.6
20	7.0 S	253.1	22.1	22.1	22.1	22.2	22.3	22.3	22.2	22.4	22.3	22.3	22.3
21	9.2 S	251.6	23.4	23.5	23.5	23.4	23.4	23.3	23.4	23.3	23.2	23.2	23.3
22	12.0 S	249.8	23.7	23.6	23.6	23.7	23.7	23.8	23.8	23.9	23.9	23.9	23.9
23	14.2 S	248.1	23.7	23.8	23.7	23.7	23.7	23.7	23.9	23.9	24.0	24.0	24.0
24	16.7 S	247.0	23.7	23.7	23.7	23.9	24.0	24.2	24.2	24.1	24.0	24.0	24.2
25	19.2 S	245.9	24.1	24.2	24.1	24.0	23.7	23.9	23.6	23.6	23.6	23.6	23.6
26	21.6 S	245.6	23.6	23.6	23.6	23.5	23.5	23.5	23.6	23.5	23.6	23.6	23.5
27	23.3 S	245.2	23.1	23.1	23.1	23.2	23.4	23.6	23.5	23.3	23.4	23.4	23.4
28	24.8 S	244.7	23.2	23.2	23.1	23.1	23.2	23.1	23.2	23.2	23.2	23.2	23.2
29	26.6 S	244.7	23.2	23.3	23.3	23.3	23.3	23.3	23.4	23.3	23.2	23.2	23.2
30	28.1 S	244.9	22.7	22.7	22.8	22.7	23.0	23.2	22.8	22.7	22.7	22.7	23.1
Dec. 1	29.2 S	245.2	23.0	22.7	22.7	22.7	22.7	22.8	22.9	22.8	22.8	22.9	23.0
7	30.6 S	245.7	22.4	22.7	22.7	22.7	22.7	22.9	22.8	22.6	22.4	22.4	22.7
13[d]	28.2 S	250.8	23.6	23.6	23.6	23.6	23.6	23.6	23.7	23.7	23.6	23.6	24.0
14	29.4 S	251.1	23.8	23.9	24.0	23.9	23.9	23.8	23.8	23.7	23.6	23.5	23.6
15	31.1 S	250.5	21.5	21.7	21.7	21.4	21.3	21.2	21.3	21.3	21.2	21.2	21.1

[a] Carnegie at Barbados September 16-October 1; at Balboa October 11-25. [b] Small, rapid fluctuations especially during midday hours; off Galapagos Islands; partly cloudy, gentle breeze. [c] Small, rapid

temperature, Carnegie, 1928-29--Continued

local mean hour													Mean
11	12	13	14	15	16	17	18	19	20	21	22	23	
													°C
27.9	27.7	27.7	27.7	27.7	27.6	27.5	27.5	27.4	27.3	27.2	27.2	27.2	27.40
27.4	27.3	27.3	27.5	27.5	27.4	27.3	27.2	27.4	27.2	27.2	27.2	27.2	27.25
27.4	27.4	27.2	27.2	27.2	27.2	27.2	27.2	27.1	26.9	27.0	27.1	27.1	27.18
27.6	27.6	27.7	27.5	27.4	27.5	27.5	27.6	27.6	27.6	27.7	27.5	27.5	27.35
27.6	27.6	28.0	27.8	27.6	27.7	27.5	27.4	27.4	27.3	27.2	27.2	27.2	27.47
27.6	27.7	27.8	27.9	27.9	27.8	27.8	27.6	27.6	27.6	27.5	27.5	27.4	27.48
27.8	27.8	27.8	28.0	27.9	28.0	27.8	27.8	27.8	27.7	27.4	27.5	27.5	27.67
28.2	28.2	28.3	28.0	28.3	28.2	28.2	27.9	27.8	27.8	27.7	27.6	27.5	27.88
28.0	28.2	28.2	28.4	28.1	28.4	28.5	28.3	28.4	27.9	28.0	27.7	27.7	27.86
27.9	27.9	28.0	28.0	27.9	28.8	28.1	28.0	28.1	28.0	28.1	28.0	28.0	27.91
28.1	28.2	28.3	28.4	28.7	28.5	28.5	28.3	28.1	28.1	28.1	28.0	28.1	28.12
27.9	28.0	28.0	28.1	28.0	28.0	28.0	28.0	27.8	27.8	27.7	27.6	27.6	27.91
27.5	27.7	27.8	27.9	27.9	27.9	27.8	27.6	27.6	27.6	27.6	27.5	27.6	27.60
28.1	28.1	28.1	28.2	28.2	28.1	28.1	28.0	27.9	27.8	27.8	27.8	27.8	27.83
27.6	27.6	27.6	27.7	27.7	27.8	27.8	27.8	27.7	27.7	27.7	27.7	27.6	27.67
28.0	28.0	28.0	28.1	28.1	28.0	28.1	28.0	27.9	28.0	28.0	28.0	27.7	27.84
28.0	28.1	28.1	28.1	28.2	28.2	28.1	28.1	28.0	28.0	28.0	27.8	27.7	27.94
28.3	28.3	28.3	28.3	28.5	28.3	28.2	28.1	28.2	28.2	28.3	28.2	28.2	28.13
28.6	29.2	28.6	28.6	28.5	28.4	28.3	28.6	28.6	28.6	28.2	28.3	28.4	28.38
28.6	28.8	28.9	28.8	28.8	28.7	28.6	28.6	28.5	28.3	28.3	28.2	28.3	28.51
28.5	28.4	28.5	28.6	28.5	28.4	28.3	28.4	28.3	28.4	28.5	28.6	28.6	28.44
28.2	28.2	28.3	28.6	28.7	28.6	28.1	28.0	28.0	28.1	27.9	28.3	28.4	28.30
28.5	28.6	28.7	28.7	28.6	28.6	28.5	28.5	28.3	28.2	28.3	28.4	28.4	28.49
28.7	28.7	28.7	28.7	28.7	28.7	28.7	28.6	28.5	28.4	28.3	28.3	27.9	28.54
28.6	28.7	28.7	28.6	28.4	28.6	28.6	28.6	28.4	28.3	28.3	28.2	28.1	28.44
28.5	28.5	28.6	28.6	28.5	28.4	28.2	28.3	28.2	28.2	28.4	28.3	28.4	28.33
28.5	28.5	28.6	28.7	28.7	28.7	28.6	28.7	28.7	28.8	28.7	28.3	28.6	28.58
27.4	27.4	27.3	27.2	27.3	27.3	27.3	27.3	27.4	27.3	27.3	27.3	27.2	27.48
27.2	27.2	27.1	27.0	26.8	26.7	26.7	26.6	26.6	26.7	26.6	26.8	26.8	26.97
26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.75
27.2	27.1	27.1	27.0	26.7	27.1	26.8	26.9	26.6	26.6	26.6	26.6	26.6	26.79
26.5	26.5	26.5	26.5	26.4	26.6	26.4	26.3	26.5	26.5	26.3	26.3	26.4	26.51
27.0	27.0	27.1	27.0	27.1	27.0	27.0	26.9	26.9	27.0	26.9	26.9	26.8	26.77
27.2	27.2	27.0	27.1	27.2	27.0	26.9	27.1	27.0	26.9	26.9	26.9	27.0	27.03
27.1	27.0	26.9	26.9	26.9	26.9	26.9	26.9	26.9	26.8	26.7	26.6	26.6	26.92
26.5	26.6	26.6	26.7	26.6	26.4	26.4	26.3	26.2	26.2	26.2	26.2	26.2	26.45
26.2	26.1	26.1	26.1	26.2	26.1	26.1	25.9	25.9	26.0	26.1	26.1	26.1	26.14
26.0	25.8	25.8	25.7	25.8	25.8	25.8	25.8	25.4	25.4	25.3	25.7	25.7	25.87
25.1	25.4	25.4	25.3	25.3	25.3	25.2	25.2	25.2	25.1	24.9	24.9	24.8	25.20
23.2	23.1	23.0	23.1	23.2	23.2	23.2	23.2	23.2	23.2	23.2	23.2	23.2	23.59
22.3	22.3	21.9	21.1	20.9	20.7	20.2	20.2	19.6	19.6	19.5	19.4	19.4	21.58
19.7	19.8	20.1	19.8	19.9	20.0	19.9	19.8	19.8	19.8	19.6	19.4	19.3	19.52
20.6	20.7	21.2	21.2	21.4	21.6	21.7	21.8	21.8	21.7	21.7	21.8	21.7	20.77
20.9	20.9	21.1	21.2	21.3	21.3	21.0	20.9	20.8	20.6	20.3	19.1	19.4	20.98
19.4	19.6	19.8	19.8	19.2	19.1	18.8	18.2	18.1	17.3	17.4	17.6	17.7	18.92
18.8	19.4	19.4	19.5	19.3	19.4	19.3	19.2	19.2	19.1	19.2	19.2	19.1	18.75
19.0	19.2	19.3	19.4	19.4	19.4	19.3	19.3	19.3	19.3	19.4	19.6	19.3	19.10
19.8	19.9	20.1	20.2	20.2	20.2	20.2	20.1	20.1	20.2	20.2	20.2	20.3	19.83
20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.8	20.7	20.7	20.7	20.7	20.7	20.61
20.8	20.9	21.0	21.1	21.1	21.1	21.2	21.2	21.3	21.3	21.3	21.3	21.3	20.95
21.5	21.7	21.9	22.3	22.4	22.5	22.4	22.4	22.4	22.4	22.4	22.4	22.4	21.78
22.7	22.8	22.8	22.7	22.6	22.6	22.6	22.6	22.2	22.2	22.2	22.1	22.1	22.48
22.3	22.4	22.4	22.5	22.6	22.6	22.7	22.7	23.0	23.1	23.4	23.3	23.4	22.54
23.3	23.4	23.4	23.5	23.7	23.7	23.7	23.7	23.8	23.7	23.7	23.7	23.7	23.50
23.9	23.9	24.0	23.8	23.8	23.7	23.7	23.7	23.7	23.7	23.6	23.6	23.7	23.76
24.0	24.0	24.1	24.2	24.2	24.2	24.2	24.2	24.2	23.9	23.7	23.7	23.7	23.93
24.2	24.2	24.2	24.2	24.2	23.8	23.8	24.0	24.0	23.8	23.8	23.8	23.8	23.98
23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.70
23.6	23.6	23.4	23.4	23.2	23.3	23.4	23.3	23.2	23.1	23.1	23.1	23.1	23.41
23.5	23.7	23.7	23.7	23.7	23.6	23.6	23.5	23.3	23.2	23.1	23.1	23.2	23.39
23.3	23.5	23.6	23.7	23.7	23.6	23.3	23.3	23.3	23.3	23.2	23.2	23.2	23.30
23.2	23.3	23.3	23.3	23.3	23.2	23.1	23.1	23.1	22.7	23.0	23.1	23.0	23.20
23.2	23.3	23.1	23.0	23.0	23.1	23.1	23.0	23.0	23.0	23.1	23.1	23.1	22.97
23.0	23.1	23.0	23.1	23.2	23.2	23.2	23.2	23.2	23.0	22.7	22.8	22.8	22.94
23.1	23.2	23.3	22.9	23.2	22.9	22.9	23.0	22.8	22.8	23.0	22.8	22.7	22.82
24.3	24.2	24.3	24.2	24.3	24.2	24.1	24.2	24.2	24.0	24.0	24.0	23.9	23.92
23.6	23.7	23.7	23.8	23.8	23.8	23.7	23.2	23.1	23.1	22.7	22.2	21.7	23.48
21.1	21.1	21.1	21.0	20.8	20.7	20.8	20.8	20.8	20.8	20.6	20.6	20.2	21.05

fluctuations during midday hours; overcast, gentle to light breeze. [d] Carnegie at Easter Island December 6-12.

Table 79. Hourly values of sea-surface

Date	Latitude	Longitude east	Values in °C, 00	01	02	03	04	05	06	07	08	09	10
1928	°	°											
Dec. 16	32.0 S	249.1	20.1	20.0	19.8	19.9	20.1	20.2	20.1	20.1	20.2	20.2	20.3
17	31.8 S	250.6	20.6	20.5	20.5	20.6	20.6	20.6	20.8	20.8	20.8	20.9	21.1
18	31.9 S	251.0	20.9	20.7	20.7	20.7	20.7	20.7	20.7	21.0	21.0	21.0	21.1
19	32.5 S	252.6	19.4	19.4	19.5	19.6	19.6	19.7	19.7	19.8	19.9	20.2	20.5
20	34.0 S	253.4	19.4	19.5	19.7	19.6	19.7	19.7	19.7	19.6	19.2	19.1	19.2
21	35.3 S	254.6	19.2	18.8	18.7	18.8	18.7	18.9	19.0	19.1	19.2	19.4	19.3
22	36.9 S	255.9	18.4	18.0	17.3	17.1	17.0	16.8	17.0	17.0	16.7	16.7	16.9
23	38.7 S	257.1	16.3	16.4	16.3	16.3	16.3	16.2	16.1	16.2	16.2	16.1	15.8
24	39.9 S	259.0	15.3	15.5	15.7	15.8	15.8	15.8	15.8	16.1	16.3	16.4	16.4
26	40.4 S	262.5	14.8	14.6	14.7	14.6	14.7	14.7	14.7	14.7	14.8	15.0	15.4
27	39.9 S	263.7	15.5	15.3	15.4	15.3	15.4	15.4	15.4	15.5	15.7	16.0	15.8
28	38.4 S	265.8	16.7	16.7	16.7	16.8	16.8	16.6	16.6	16.7	16.8	17.1	17.1
29	36.6 S	267.0	17.7	17.8	17.8	17.8	17.8	17.8	17.9	18.3	18.4	18.7	18.7
30	34.5 S	268.2	18.6	18.6	18.4	18.3	18.7	19.1	19.1	19.2	19.2	19.4	19.4
31	32.5 S	270.0	19.4	19.4	19.3	19.3	19.4	19.6	19.4	19.7	19.9	20.2	20.4
1929													
Jan. 1[a]	32.2 S	270.9	20.3	20.2	20.3	20.1	20.3	20.4	20.5	20.3	20.3	20.7	20.8
2	31.9 S	271.1	20.9	21.1	20.8	20.7	20.6	20.8	20.6	20.6	20.8	20.7	21.1
3	31.9 S	271.7	20.8	20.7	20.8	20.7	20.6	20.6	20.6	20.6	20.6	20.8	20.9
4	31.8 S	272.7	20.6	20.7	20.8	20.4	20.5	20.5	20.5	20.5	20.8	20.7	20.6
5	31.0 S	273.4	20.3	20.2	20.1	20.3	20.2	20.2	20.2	20.3	20.2	20.2	20.3
6	28.9 S	274.7	19.9	19.7	19.8	19.8	20.0	19.8	19.7	19.8	19.9	19.8	20.0
7	27.0 S	276.0	19.6	19.7	19.7	19.6	19.3	19.6	19.5	19.5	19.3	19.4	19.4
8	25.0 S	277.8	19.1	19.0	19.0	19.0	19.0	19.0	19.1	19.2	19.2	19.2	19.2
9	23.1 S	278.8	19.2	19.2	19.1	19.1	19.0	19.0	19.1	19.2	19.2	19.1	19.1
10	21.4 S	279.5	18.8	18.9	18.8	19.2	19.1	19.2	19.2	19.2	19.2	19.2	19.1
11	19.1 S	280.7	18.9	18.8	18.8	18.8	18.8	18.8	19.0	19.1	19.2	19.2	19.5
12	16.7 S	281.4	19.7	19.9	20.2	20.3	20.7	21.1	21.3	21.3	21.2	21.4	21.5
13	14.1 S	282.1	22.1	22.0	21.9	21.9	22.1	22.1	21.6	21.4	21.1	20.8	21.0
14[b]	12.3 S	282.8	21.5	20.6	20.1	19.7	19.5	19.3	19.5	19.4	19.4	19.2	18.8
Feb. 6[c]	11.9 S	281.4	21.1	21.4	21.7	22.4	23.0	23.3	23.3	23.3	23.3	23.3	23.3
7	10.2 S	280.1	23.2	23.3	23.5	23.7	23.7	23.5	23.3	22.9	23.1	23.1	23.0
8	10.0 S	277.8	23.9	24.0	24.0	24.0	24.2	24.9	24.9	25.0	24.9	24.9	24.9
9	10.4 S	275.8	24.8	24.8	24.8	24.8	24.8	24.9	24.8	24.8	24.7	24.7	24.8
10	10.8 S	275.0	25.1	25.0	24.9	24.9	24.9	24.9	24.9	25.0	25.1	25.2	25.5
11[d]	10.7 S	274.1	25.5	25.4	25.4	25.3	25.3	25.2	25.2	25.2	25.1	25.2	25.2
12	11.0 S	272.6	24.7	24.7	24.7	24.6	24.6	24.5	24.5	24.6	24.4	24.3	24.3
13	12.6 S	270.3	24.2	24.2	24.1	24.1	24.1	24.0	23.9	23.9	23.9	23.9	23.8
14	14.4 S	267.8	23.1	23.0	22.8	22.8	22.8	22.8	22.8	22.8	22.8	22.8	22.8
15	15.8 S	265.1	22.8	22.9	22.9	22.9	22.8	22.7	22.7	22.8	22.8	22.8	22.8
16	15.3 S	262.4	22.9	23.0	23.2	23.3	23.3	23.3	23.3	23.2	23.2	23.3	23.3
17	14.8 S	259.2	23.2	23.2	23.2	23.2	23.2	23.4	23.5	23.5	23.5	23.5	23.5
22	12.6 S	247.7	25.0	25.1	25.2	25.1	25.0	25.0	25.2	25.2	25.2	25.2	25.2
23	12.5 S	244.9	25.3	25.3	25.4	25.5	25.5	25.4	25.6	25.6	25.6	25.6	25.6
24	12.7 S	242.4	25.7	25.7	25.7	25.7	25.7	25.8	26.0	26.0	26.0	26.0	26.0
25	12.8 S	240.6	26.1	26.1	26.1	26.2	26.2	26.3	26.3	26.3	26.3	26.3	26.4
26	13.0 S	238.7	26.3	26.3	26.4	26.4	26.4	26.4	26.3	26.4	26.4	26.4	26.4
27	13.5 S	235.9	26.6	26.6	26.7	26.7	26.7	26.7	26.8	26.7	26.7	26.7	26.7
28	14.9 S	233.8	26.7	26.8	26.9	26.9	27.0	27.1	27.1	27.1	27.1	27.1	27.1
Mar. 1	16.5 S	231.9	27.3	27.3	27.3	27.3	27.4	27.5	27.5	27.4	27.4	27.4	27.4
2	17.0 S	230.2	27.4	27.5	27.4	27.4	27.4	27.4	27.3	27.3	27.3	27.4	27.5
3	17.1 S	228.3	27.5	27.5	27.5	27.6	27.6	27.6	27.6	27.6	27.6	27.6	27.6
5	17.1 S	224.6	27.5	27.5	27.5	27.5	27.6	27.5	27.5	27.5	27.5	27.6	27.6
6[e]	17.2 S	223.4	27.8	27.8	27.8	27.8	27.8	27.8	27.8	27.8	27.8	27.9	28.0
7[f]	17.4 S	221.1	28.4	28.6	27.9	28.6	28.1	27.8	28.1	27.8	27.9	28.1	28.4
8	17.8 S	219.2	28.2	28.1	28.2	28.2	28.2	28.2	28.1	28.1	28.3	28.1	28.6
9	17.6 S	218.0	28.2	28.1	28.1	28.2	28.2	28.0	28.1	28.1	28.2	28.2	28.3
10	18.0 S	215.9	28.1	28.1	28.2	28.3	28.2	28.2	28.2	28.1	28.1	28.1	28.1
11	18.1 S	214.4	28.0	28.1	28.2	28.2	28.2	28.1	27.8	27.9	27.8	27.8	27.8
12	17.9 S	212.0	28.0	28.0	28.0	28.2	28.3	28.2	28.1	28.1	28.0	28.1	28.3
21[c]	16.8 S	209.2	28.2	28.3	28.3	28.3	28.2	28.2	28.2	28.2	28.2	28.2	28.3
22	17.6 S	208.2	28.3	28.3	28.3	28.4	28.4	28.4	28.4	28.3	28.3	28.2	28.1
23	17.2 S	207.3	28.1	28.1	28.1	28.3	28.3	28.3	28.3	28.2	28.3	28.4	28.5
24	16.9 S	206.3	28.7	28.4	28.6	28.8	28.7	28.7	28.6	28.6	28.6	28.6	28.7
25	16.5 S	204.0	28.6	28.7	28.6	28.6	28.6	28.5	28.4	28.4	28.4	28.3	28.3
27	15.7 S	199.4	28.7	28.7	28.7	28.6	28.7	28.6	28.6	28.6	28.5	28.5	28.5
28	15.5 S	198.0	28.6	28.5	28.5	28.6	28.5	28.5	28.5	28.5	28.5	28.6	28.6
29	15.3 S	196.7	28.6	28.6	28.6	28.6	28.5	28.4	28.3	28.1	28.2	28.3	28.3
30	14.7 S	194.4	28.7	29.0	28.6	28.5	28.5	28.6	28.7	28.7	28.7	28.9	29.0

[a] Very rapid fluctuations of as much as 2°5 within 15m, between 10h and 24h; western edge of Humboldt Current. [b] Irregular fluctuations between 09h and 19h; fall in temperature of about 5°5. [c] Carnegie at Callao January 14-February 5; at Papeete March 13-20. [d] Calm, clear day with characteristic

temperature, Carnegie, 1928-29--Continued

local mean hour													Mean
11	12	13	14	15	16	17	18	19	20	21	22	23	
													°C
20.4	20.4	20.3	20.3	20.2	20.0	20.2	20.5	20.6	20.6	20.6	20.6	20.6	20.26
21.0	21.2	20.9	21.1	21.2	21.3	21.2	21.2	21.2	21.1	21.1	21.0	21.0	20.93
21.1	21.1	20.8	20.6	20.7	19.9	19.7	19.7	19.7	19.6	19.6	19.5	19.5	20.45
20.7	20.5	20.2	20.3	20.2	20.0	19.8	19.7	19.3	19.2	19.3	19.5	19.4	19.81
19.3	19.3	19.7	19.8	19.7	19.7	19.5	19.5	19.6	19.5	19.4	19.4	19.3	19.50
19.3	19.4	19.6	19.7	19.8	19.9	19.3	19.0	18.7	18.3	18.4	18.3	18.1	19.04
17.0	17.2	17.3	17.3	17.2	17.1	16.9	16.9	16.8	16.8	16.7	16.6	16.4	17.05
15.7	15.4	15.4	15.5	15.6	15.7	15.5	15.3	15.4	15.4	15.5	15.4	15.3	15.80
16.4	16.3	16.3	16.4	15.0	14.5	14.6	14.6	14.3	14.4	14.3	14.4	14.4	15.45
15.5	15.8	15.9	16.2	16.3	15.9	15.7	16.0	15.9	16.0	15.8	15.6	15.8	15.38
16.2	16.4	16.5	16.4	16.3	16.2	16.3	16.3	16.3	16.6	16.6	16.7	16.7	16.01
17.2	17.3	17.0	17.8	17.6	17.6	17.5	17.5	17.8	17.8	17.8	17.7	17.7	17.20
18.8	18.8	18.9	19.3	19.3	19 6	19.5	19.6	18.9	18.8	18.8	18.8	18.7	18.60
19.5	19.4	19.4	19.7	19.8	20.1	20.0	19.8	19.8	20.0	19.7	19.7	19.4	19.35
20.3	20.7	20.8	20.6	20.9	21.0	21.2	20.8	20.3	20.4	20.3	20.2	20.3	20.16
21.3	21.9	20.5	20.6	22.9	22.8	20.6	22.0	20.6	22.0	20.8	20.5	20.8	20.90
21.3	21.2	21.1	21.2	21.3	20.6	20.5	20.8	20.7	20.3	20.5	20.7	20.7	20.82
21.2	21.3	21.6	21.7	21.6	21.8	21.0	21.1	20.7	20.7	20.7	20.9	20.8	20.95
20.7	20.8	21.2	21.4	21.0	21.2	21.2	21.2	21.0	20.9	20.7	20.5	20.2	20.78
20.5	20.4	20.4	20.2	20.3	20.6	20.5	20.3	20.0	20.5	20.1	20.1	20.1	20.27
19.7	19.8	19.7	19.9	19.8	19.8	19.7	19.7	19.7	19.7	19.7	19.6	19.6	19.78
19.4	19.3	19.6	19.5	19.3	19.3	19.5	19.3	19.3	19.4	19.3	19.2	19.1	19.42
19.2	19.1	19.2	19.2	19.2	19.2	19.4	19.4	19.4	19.3	19.2	19.3	19.2	19.18
19.2	19.2	19.2	19.2	19.2	19.2	19.2	19.2	19.2	19.1	19.1	18.9	18.8	19.13
19.1	19.2	19.2	19.2	19.2	19.2	19.2	19.2	19.2	19.2	19.0	19.0	19.1	19.12
19.8	19.9	19.9	20.0	19.9	19.8	19.8	19.8	19.7	19.7	19.8	19.6	19.5	19.42
21.5	21.4	21.3	21.3	21.2	21.1	20.9	20.9	20.9	21.0	21.0	21.4	21.8	21.01
21.2	21.0	21.1	21.4	21.4	21.5	21.5	21.5	21.6	21.7	21.9	21.7	21.5	21.54
18.7	19.2	18.9	18.0	16.7	14.8	13.9	14.1	14.0	13.9	13.9	13.9	13.8	17.53
23.5	23.5	23.4	22.9	22.9	23.0	23.1	23.1	23.1	23.1	23.0	23.0	23.0	22.92
23.2	23.5	23.7	23.7	23.7	23.4	23.6	23.7	24.1	24.2	24.2	24.2	23.9	23.56
25.0	25.0	25.1	25.1	25.2	25.1	25.1	25.0	25.0	24.9	24.8	24.8	24.8	24.77
24.9	25.1	25.2	25.4	25.6	25.7	25.7	25.5	25.3	25.2	25.2	25.1	25.2	25.08
25.7	25.8	25.9	25.7	25.6	26.4	27.4	26.7	26.0	25.7	25.6	25.6	25.4	25.54
25.4	25.6	25.6	25.6	25.6	25.6	25.4	25.3	25.1	25.0	24.0	24.8	24.8	25.28
24.3	24.3	24.3	24.3	24.3	24.3	24.3	24.2	24.2	24.1	24.2	24.2	24.2	24.38
23.8	23.9	24.0	23.9	23.9	23.8	23.7	23.6	23.6	23.6	23.5	23.4	23.2	23.83
22.8	22.8	22.9	22.9	22.9	22.8	22.9	22.8	22.8	22.8	22.7	22.7	22.7	22.83
22.8	22.9	22.9	22.9	23.0	23.1	23.1	23.1	23.1	23.0	23.0	23.0	23.0	22.91
23.3	23.2	23.2	23.2	23.2	23.2	23.3	23.3	23.3	23.4	23.4	23.3	23.2	23.24
23.4	23.5	23.5	23.6	23.6	23.7	23.7	23.7	23.6	23.6	23.6	23.6	23.7	23.49
25.2	25.2	25.4	25.4	25.5	25.5	25.3	25.5	25.6	25.4	25.4	25.4	25.4	25.28
25.6	25.6	25.7	25.6	25.6	25.6	25.6	25.6	25.6	25.6	25.6	25.7	25.7	25.56
26.0	26.0	26.0	26.1	26.1	26.1	26.1	26.1	26.1	26.1	26.0	26.1	26.2	25.97
26.5	26.6	26.6	26.6	26.6	26.6	26.6	26.6	26.5	26.5	26.5	26.4	26.4	26.40
26.4	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.6	26.7	26.7	26.46
26.7	26.7	26.7	26.7	26.7	26.8	26.8	26.8	26.8	26.7	26.7	26.7	26.7	26.71
27.1	27.1	27.2	27.3	27.3	27.3	27.3	27.4	27.3	27.3	27.3	27.2	27.2	27.13
27.4	27.5	27.5	27.5	27.6	27.6	27.5	27.5	27.5	27.5	27.5	27.5	27.5	27.45
27.5	27.5	27.5	27.6	27.6	27.6	27.6	27.5	27.6	27.5	27.5	27.5	27.5	27.47
27.6	27.7	27.7	27.8	27.9	27.7	27.7	27.7	27.6	27.6	27.5	27.6	27.5	27.62
27.6	27.7	27.7	27.8	27.8	27.8	27.8	27.8	27.8	27.8	27.8	27.8	27.8	27.66
28.2	28.2	28.8	28.7	29.6	29.7	29.8	29.1	29.1	28.3	28.3	28.9	28.5	28.39
28.3	28.9	29.6	29.6	29.5	29.6	29.5	29.0	28.7	28.6	28.6	28.2	28.2	28.58
28.7	28.7	29.0	29.1	28.9	28.9	28.6	28.6	28.5	28.4	28.4	28.4	28.3	28.45
28.4	28.4	28.5	28.4	28.4	28.5	28.3	28.3	28.2	28.2	28.1	28.2	28.2	28.24
28.2	28.2	28.2	28.2	28.3	28.2	28.2	28.2	27.7	27.8	28.2	28.1	27.9	28.13
27.8	27.9	27.8	27.7	27.7	27.7	27.7	27.7	27.7	27.8	27.7	27.8	27.9	27.87
28.2	28.3	28.2	28.1	28.2	28.4	28.4	28.5	28.5	28.4	28.4	28.3	28.5	28.24
28.3	28.3	28.4	28.2	28.2	28.2	28.2	28.2	28.3	28.3	28.3	28.3	28.3	28.25
28.0	28.0	28.0	28.1	28.1	28.1	28.1	28.1	28.0	28.0	28.0	28.1	28.1	28.17
28.7	28.6	29.2	29.3	29.5	29.4	29.2	28.8	28.7	28.8	28.7	28.7	28.9	28.64
29.1	28.7	28.7	28.7	28.7	28.8	28.7	28.6	28.5	28.6	28.7	28.5	28.6	28.66
28.4	28.5	28.5	28.6	28.6	28.5	28.6	28.5	28.6	28.6	28.6	28.6	28.4	28.52
28.5	28.6	28.6	28.6	28.7	28.7	28.7	28.6	28.6	28.6	28.6	28.6	28.6	28.61
28.6	28.7	28.8	29.0	28.9	28.8	28.8	28.7	28.8	28.7	28.7	28.6	28.6	28.65
28.3	29.5	29.6	30.0	29.9	29.7	29.5	29.4	28.7	28.7	28.7	28.6	28.6	28.82
29.1	29.5	29.6	29.6	29.6	29.5	29.5	29.3	29.5	29.1	29.1	29.1	29.1	29.06

small, rapid changes in temperature during late afternoon. [e] Small, rapid fluctuations in temperature during late afternoon; clear, calm. [f] Small, rapid fluctuations in temperature during late afternoon; clear, calm.

Table 79. Hourly values of sea-surface

Date	Latitude	Longitude east	Values in °C, 00	01	02	03	04	05	06	07	08	09	10
1929	°	°											
Mar. 31	14.7 S	192.1	29.0	29.1	29.1	29.0	28.9	28.8	28.7	28.6	28.6	28.6	28.6
Apr. 22[a]	12.7 S	188.4	29.4	29.4	29.4	29.4	29.3	29.3	29.2	29.2	29.2	29.2	29.2
23	11.3 S	188.4	29.1	29.3	29.3	29.3	29.3	29.3	29.3	29.3	29.3	29.2	29.2
24	8.7 S	189.0	29.1	29.4	29.3	29.3	29.3	29.3	29.2	29.2	29.2	29.2	29.2
25[b]	7.6 S	188.2	29.2	29.2	29.2	29.1	29.1	29.1	29.1	29.1	29.1	29.0	29.0
26[c]	6.7 S	187.6	29.1	29.1	29.1	29.1	29.1	29.1	29.1	29.0	29.0	29.1	29.1
27[d]	5.1 S	187.6	28.9	29.1	28.8	28.7	28.7	28.6	28.4	28.4	28.4	28.4	28.6
28	3.8 S	187.4	28.1	28.3	28.2	28.2	28.1	28.1	28.1	28.1	28.0	28.1	28.1
29	1.8 S	186.6	28.1	28.0	27.8	27.8	27.7	27.7	27.7	27.6	27.6	27.6	27.6
30	0.4 N	185.9	27.2	27.2	27.2	27.2	27.1	27.0	26.9	26.9	26.8	26.8	26.8
May 1	2.5 N	184.9	27.2	27.2	27.2	27.2	27.1	27.1	27.2	27.4	27.5	27.5	27.6
2	4.4 N	183.6	27.9	27.8	27.8	27.7	27.7	27.7	27.7	27.7	27.6	27.6	27.6
3	6.5 N	182.3	27.6	27.7	27.7	27.7	27.7	27.6	27.7	27.7	27.6	27.7	27.7
4	8.2 N	181.1	27.6	27.5	27.5	27.5	27.5	27.5	27.5	27.4	27.4	27.4	27.4
5	10.8 N	180.5	27.2	27.2	27.2	27.2	27.2	27.0	27.0	26.9	26.9	26.8	26.8
	Crossed International Date Line												
7	13.5 N	177.4	26.2	26.5	26.4	26.2	26.2	26.2	26.2	26.2	26.2	26.2	26.2
8	15.4 N	174.7	26.0	25.9	25.9	25.9	26.1	26.1	26.0	26.0	26.0	25.9	25.9
9	16.5 N	171.9	26.1	26.2	26.1	25.9	25.7	25.7	25.6	25.7	25.7	25.7	25.7
10	18.5 N	169.0	26.0	26.0	26.0	25.9	25.8	25.7	25.7	25.7	25.7	25.7	25.7
12	20.3 N	163.7	25.6	25.5	25.5	25.6	25.7	25.7	25.7	25.7	25.7	25.7	25.7
13	20.2 N	161.2	25.8	25.8	25.9	25.9	25.7	25.7	25.7	25.7	25.7	25.7	25.9
14	19.5 N	158.5	26.7	26.6	26.4	26.3	26.3	26.2	26.2	26.1	26.1	26.1	26.2
15	18.7 N	156.1	26.8	26.8	26.8	26.8	26.8	26.8	26.8	26.8	26.8	26.8	26.8
16	17.5 N	153.4	27.3	27.3	27.2	27.2	27.1	27.1	27.2	27.3	27.2	27.1	26.9
17	16.1 N	150.9	27.3	27.3	27.3	27.3	27.3	27.3	27.2	27.1	27.1	27.1	27.1
18	14.9 N	148.3	27.6	27.6	27.6	27.6	27.6	27.6	27.5	27.5	27.5	27.5	27.5
19	14.0 N	146.0	27.7	27.7	27.7	27.7	27.7	27.7	27.7	27.7	27.7	27.7	27.7
26[a]	16.1 N	144.2	28.2	28.2	28.2	28.1	28.1	28.2	28.2	28.1	28.1	28.2	28.2
27	18.6 N	144.0	28.3	28.1	28.1	28.2	28.1	28.1	28.1	28.1	28.1	28.1	28.1
28	21.5 N	144.2	28.7	28.7	28.7	28.7	28.6	28.6	28.7	28.6	28.2	28.3	28.3
29	23.4 N	144.2	28.6	28.7	28.6	28.5	28.5	27.4	27.6	27.2	27.3	27.3	27.3
30[e]	25.3 N	144.1	25.8	26.3	26.3	25.9	26.0	26.3	26.2	26.6	26.5	26.7	26.6
31	26.4 N	144.4	25.9	25.3	24.0	23.7	23.9	23.7	24.4	23.9	24.1	23.9	23.9
June 1	28.5 N	144.0	23.5	24.1	24.2	24.2	24.1	23.9	24.2	24.0	24.0	24.1	24.0
2	30.2 N	143.9	20.7	20.5	20.5	20.5	20.5	20.4	20.5	20.5	20.4	20.1	20.3
3	31.1 N	144.3	20.5	20.4	20.3	20.3	20.4	20.5	20.3	20.1	20.1	20.1	20.1
4	32.7 N	142.3	20.1	20.3	20.3	20.3	20.2	20.0	20.1	20.1	20.2	20.1	20.0
5	34.0 N	141.2	21.9	22.3	22.4	22.5	22.7	23.0	23.2	23.3	23.3	23.3	23.3
6	34.9 N	140.2	19.9	19.1	18.5	18.5	18.5	18.8	18.8	19.0	18.8	18.5	18.9
7[f]	34.9 N	139.9	18.3	18.3	18.2	18.0	18.2	18.2	18.0	18.5	18.5	17.7	15.6
25[g]	34.7 N	141.0	24.5	24.5	24.2	24.4	24.3	24.1	24.1	24.0	24.1	24.2	24.3
26	36.0 N	142.1	23.4	20.0	20.0	20.1	20.2	20.1	19.4	19.5	19.5	19.5	19.5
27	36.7 N	143.6	19.1	18.9	18.8	18.5	18.8	19.2	19.6	19.8	19.7	19.8	20.2
28	36.8 N	145.4	20.5	20.0	20.0	20.4	19.9	19.8	20.0	19.8	20.0	19.8	19.8
29	37.8 N	145.5	20.0	19.5	19.5	19.9	20.1	20.3	20.4	20.4	20.5	20.5	20.5
30[h]	38.1 N	147.1	20.7	21.0	20.7	19.0	19.0	19.0	19.0	18.9	18.8	17.7	15.5
July 1	38.7 N	147.7	15.0	14.9	14.6	14.7	14.8	14.9	15.4	15.5	15.7	16.0	16.0
2	39.8 N	149.5	16.0	15.7	15.5	15.4	15.5	15.5	15.4	15.2	15.2	15.1	13.1
3	40.4 N	151.1	15.0	14.6	14.5	14.7	14.9	15.0	15.5	15.5	15.8	15.9	15.9
4	41.3 N	153.1	15.3	14.5	14.1	13.1	13.8	14.0	13.9	13.5	12.5	12.5	13.2
5	42.6 N	155.6	10.4	10.2	10.4	10.3	10.4	10.3	10.2	10.3	10.3	10.3	10.3
6	43.8 N	158.3	10.1	9.4	10.2	9.5	9.4	9.4	9.5	9.5	9.3	9.6	9.6
7	45.4 N	159.6	7.9	7.9	7.7	7.8	7.6	7.5	7.3	7.1	7.0	6.9	6.9
8[i]	46.9 N	163.0	7.2	7.1	7.1	7.0	7.0	7.1	7.1	7.2	7.5	7.9	6.8
9	47.0 N	166.6	7.4	7.3	7.2	7.2	7.3	7.3	7.3	7.4	7.1	7.2	7.2
10	46.7 N	169.5	7.6	7.5	7.4	7.4	7.4	7.4	7.3	7.3	7.3	7.3	7.4
11	46.0 N	171.7	7.8	7.9	7.9	7.9	7.9	7.9	7.8	7.6	7.5	7.4	7.5
12	45.3 N	173.1	8.9	8.6	8.7	8.6	8.7	8.7	8.6	8.6	8.6	8.6	8.6
13	46.2 N	174.1	8.7	8.9	8.9	8.9	8.8	8.5	8.5	8.4	8.4	8.3	8.2
14[a]	48.1 N	178.1	8.3	8.4	8.4	8.4	8.2	8.2	8.2	8.2	8.2	8.1	8.2
14[b]	49.2 N	183.3	8.3	8.3	8.4	8.4	8.4	8.2	8.2	8.1	8.0	8.1	8.1
15	50.5 N	187.2	8.2	8.3	8.3	8.4	8.2	8.2	8.1	8.2	8.2	8.2	8.1
16	51.4 N	192.7	8.2	8.2	8.4	8.4	8.4	8.4	8.5	8.6	8.5	8.8	8.8

[a] Carnegie at Pago Pago April 1-5; at Apia April 6-20; at Guam May 20-25. [b] Characteristic small, rapid fluctuations during afternoon; partly cloudy, calm during midday. [c] Characteristic small, rapid fluctuations during afternoon; partly cloudy, calm during midday. [d] Characteristic small, rapid fluctuations during afternoon; partly cloudy, calm during midday. [e] Small irregular fluctuations in temperature during entire day; partly cloudy, calm to gentle breeze. [f] Carnegie at Yokohama June 7-24. [g] Very irreg-

temperature, Carnegie, 1928-29--Continued

local mean hour													Mean
11	12	13	14	15	16	17	18	19	20	21	22	23	
													°C
28.7	28.9	29.0	29.1	29.1	29.1	28.9	28.9	28.9	28.8	28.7	28.6	28.8	28.85
29.1	29.1	29.2	29.2	29.3	29.0	29.0	29.1	29.1	29.1	29.1	29.1	29.1	29.20
29.3	29.3	29.3	29.3	29.2	29.2	29.2	29.2	29.2	29.1	29.2	29.1	29.1	29.23
29.2	29.2	29.3	29.4	29.2	29.2	29.3	29.3	29.3	29.2	29.2	29.2	29.2	29.25
29.0	29.1	29.3	29.4	29.4	29.2	29.5	29.5	29.5	29.3	29.2	29.1	29.1	29.20
29.9	29.9	29.4	29.6	29.0	29.1	29.5	29.7	29.5	29.0	29.3	29.3	29.0	29.25
29.0	29.1	29.1	29.2	29.1	29.2	28.6	28.6	28.6	28.4	28.5	28.4	28.4	28.72
28.2	28.2	28.4	28.4	28.5	28.5	28.4	28.4	28.2	28.2	28.1	28.1	28.1	28.21
27.6	27.5	27.5	27.6	27.6	27.6	27.6	27.6	27.4	27.3	27.3	27.2	27.2	27.59
26.8	26.8	26.9	27.1	27.2	27.2	27.2	27.2	27.2	27.2	27.2	27.2	27.2	27.06
27.6	27.7	27.8	27.9	28.0	27.9	27.9	27.9	27.9	27.9	27.8	27.8	27.8	27.59
27.6	27.6	27.6	27.6	27.6	27.7	27.7	27.7	27.7	27.7	27.7	27.6	27.6	27.68
27.6	27.6	27.6	27.6	27.6	27.6	27.5	27.6	27.6	27.6	27.6	27.6	27.6	27.63
27.4	27.4	27.4	27.4	27.4	27.4	27.3	27.3	27.3	27.3	27.3	27.3	27.2	27.40
26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.2	26.2	26.2	26.2	26.77
26.2	26.2	26.2	26.2	26.2	26.2	26.2	26.2	26.2	26.2	26.0	26.0	26.0	26.20
26.0	26.0	26.1	26.1	25.8	25.8	25.8	25.9	25.8	25.9	25.9	26.0	26.0	25.95
25.7	25.7	25.7	25.9	26.0	26.0	26.0	26.1	26.0	26.0	26.1	26.1	26.1	25.90
25.5	25.5	25.5	25.5	25.5	25.8	25.9	26.0	26.0	26.0	26.0	26.0	25.8	25.79
25.7	25.7	25.7	25.7	25.8	25.9	25.9	25.8	25.8	25.8	25.8	25.9	26.0	25.74
26.1	26.2	26.2	26.2	26.2	26.2	26.2	26.2	26.2	26.4	26.4	26.5	26.5	26.04
26.3	26.8	26.8	26.8	26.6	26.7	26.6	26.6	26.6	26.6	26.7	26.8	26.8	26.50
26.8	26.8	26.8	26.9	26.9	26.9	27.1	26.9	26.8	26.9	26.9	26.9	27.2	26.86
26.9	26.9	27.1	27.3	27.4	27.5	27.5	27.3	27.3	27.3	27.3	27.3	27.3	27.22
27.3	27.3	27.3	27.4	27.4	27.4	27.4	27.4	27.4	27.4	27.4	27.4	27.6	27.31
27.6	27.6	27.6	27.7	27.7	27.7	27.6	27.6	27.7	27.7	27.7	27.7	27.7	27.61
27.8	27.8	27.9	28.0	28.1	28.1	28.1	28.0	28.0	27.9	27.8	27.8	27.8	27.83
28.2	28.2	28.2	28.3	28.3	28.2	28.2	28.2	28.2	28.2	28.2	28.2	28.2	28.19
28.2	28.4	28.6	28.6	28.8	28.4	28.4	28.4	28.5	28.5	28.3	28.3	28.6	28.31
27.8	27.6	27.7	27.9	27.8	28.5	28.6	28.5	28.5	28.6	28.6	28.8	28.7	28.40
27.4	27.4	27.5	27.5	27.3	26.5	25.9	25.9	25.7	26.1	25.9	25.9	25.7	27.15
26.7	26.4	26.4	26.4	26.5	26.7	26.5	26.4	26.3	26.3	26.2	25.9	25.9	26.33
24.5	24.7	24.8	24.8	24.8	24.3	24.5	24.4	24.2	24.0	23.4	23.8	23.5	24.27
23.8	23.5	22.9	22.8	21.9	21.6	21.4	20.9	20.9	21.0	20.8	20.8	20.7	22.80
20.4	20.4	20.5	20.5	20.4	20.3	20.3	20.2	20.1	20.1	20.2	20.2	20.5	20.38
20.1	20.3	20.2	20.5	20.1	20.1	20.0	19.9	19.9	19.9	20.0	20.1	20.2	20.18
20.1	20.4	20.3	20.4	20.5	20.5	20.1	20.0	20.0	20.5	21.4	21.5	21.5	20.37
23.3	23.4	23.4	23.3	23.5	22.9	21.5	22.0	21.4	19.1	19.5	19.4	19.5	22.23
19.0	19.0	18.9	18.5	18.5	18.5	18.5	18.5	18.5	18.5	18.5	18.5	18.5	18.72
16.8	17.0	17.0	17.4	17.4	17.7	16.3	16.2	17.3	19.5	19.6	19.5	19.5	17.86
24.3	24.3	24.3	24.2	24.3	24.3	24.4	24.4	24.3	24.1	21.9	23.5	23.5	24.10
21.0	21.0	20.9	19.8	17.5	18.9	20.4	18.6	18.8	18.5	18.5	18.5	19.3	19.70
19.8	19.9	20.0	20.0	20.0	20.3	20.5	20.5	20.5	20.5	20.3	20.1	20.3	19.80
20.0	20.2	20.2	20.3	20.4	20.4	20.6	20.6	20.1	20.0	20.0	20.4	20.0	20.13
20.5	20.5	20.5	20.5	20.5	20.5	20.6	20.4	20.4	20.4	20.5	20.4	20.5	20.33
14.9	16.8	17.5	17.0	16.7	16.1	15.9	14.9	14.9	14.9	14.9	14.7	15.0	17.23
16.0	16.0	16.2	16.2	16.7	16.0	16.3	16.7	16.6	16.7	16.5	16.5	16.5	15.85
13.1	13.8	14.0	14.2	14.4	14.4	14.0	14.5	14.7	15.5	15.5	15.6	15.8	14.88
15.9	16.1	16.1	15.1	15.6	15.0	15.5	16.0	16.0	16.2	16.3	16.4	15.6	15.55
13.1	13.4	13.5	13.2	13.3	13.2	12.7	12.1	12.5	12.1	11.1	11.0	11.2	13.03
10.3	10.3	10.3	10.4	10.2	9.9	9.7	9.8	9.6	9.6	10.0	10.1	10.2	10.16
9.4	9.4	9.5	9.4	9.7	9.8	9.9	9.3	9.4	8.9	8.7	8.4	8.4	9.40
6.9	7.1	7.2	7.2	6.8	6.7	6.7	6.7	6.9	6.9	6.9	7.1	7.2	7.16
6.5	6.4	6.5	6.6	6.9	6.9	6.9	6.9	6.9	6.9	6.9	7.2	7.3	6.99
7.2	7.1	7.2	7.2	7.3	7.4	7.5	7.4	7.4	7.3	7.3	7.3	7.3	7.28
7.4	7.4	7.7	7.9	7.8	7.8	7.9	7.8	7.8	7.7	7.8	7.8	7.7	7.58
7.6	7.6	7.7	7.8	7.8	7.9	7.9	8.0	7.9	8.3	8.6	8.7	8.8	7.90
8.6	8.4	8.6	8.6	8.6	8.6	8.7	8.7	8.6	8.5	8.6	8.7	8.7	8.63
8.3	8.3	8.4	8.4	8.5	8.5	8.5	8.5	8.5	8.4	8.4	8.4	8.4	8.50
8.2	8.4	8.4	8.3	8.3	8.4	8.4	8.4	8.4	8.4	8.4	8.2	8.1	8.30
8.0	7.9	7.9	7.9	7.9	7.9	8.0	7.9	8.0	7.9	7.9	7.9	8.0	8.07
8.1	8.2	8.2	8.2	8.3	8.3	8.3	8.2	8.2	8.1	8.1	8.2	8.3	8.21
8.8	8.7	8.6	8.6	8.8	8.8	8.9	8.9	8.9	9.0	8.9	9.0	9.0	8.67

ular fluctuations beginning at 20h and continuing to 22h on 26th; in boundary zone between Japanese Current and cold on-shore currents. [h] Sudden fall in temperature of 5°.8 between 08h and 09h 30m with small, rapid fluctuations until 15h; cloudy, light airs. [i] Lowest sea-surface temperature of cruise recorded at 12h; south of Aleutian Islands.

Table 79. Hourly values of sea-surface

Date	Latitude	Longitude east	Values in °C, 00	01	02	03	04	05	06	07	08	09	10
1929	°	°											
July 17	52.4 N	198.2	9.2	9.2	9.2	9.1	9.3	9.3	9.3	9.3	9.2	9.3	9.3
18	52.6 N	204.4	9.5	9.5	9.6	9.8	9.7	9.8	9.8	9.8	9.8	9.8	10.2
19	52.0 N	209.6	10.6	10.6	10.6	10.8	10.8	10.7	10.8	10.8	10.7	10.6	10.6
20	50.2 N	213.9	10.5	10.6	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7
21	48.0 N	217.3	11.1	11.1	11.1	11.1	11.1	11.1	11.2	11.1	11.1	11.1	11.1
22	46.0 N	220.3	11.6	11.6	11.7	11.8	11.9	12.0	12.0	12.0	12.0	12.0	12.1
23	44.3 N	222.4	13.1	13.1	13.1	13.1	13.1	13.1	13.1	13.2	13.2	13.2	13.2
24	42.6 N	224.8	14.3	14.3	14.4	14.3	14.4	14.4	14.4	14.5	14.6	14.6	14.6
25	40.7 N	227.7	15.6	15.8	15.9	16.1	16.3	16.2	16.2	16.3	16.3	16.5	16.5
26	39.6 N	230.5	17.1	17.1	17.1	17.1	17.2	17.3	17.3	17.2	17.2	17.2	17.2
27	38.8 N	234.3	16.0	15.7	15.9	15.9	16.2	16.3	16.5	16.5	16.4	16.4	16.4
28[a]	38.2 N	237.2	11.8	12.0	12.2	12.2	12.2	12.6	12.0	10.4	10.2	10.0	11.6
Sep. 4[b]	37.0 N	236.3	13.9	14.4	15.6	16.6	16.6	16.8	16.5	16.3	16.3	16.3	16.3
5	35.5 N	235.0	17.2	17.4	17.5	17.1	17.4	17.5	18.1	18.2	18.4	18.4	18.1
6	33.8 N	233.7	19.1	18.1	18.6	19.0	18.6	18.8	18.9	19.4	19.1	19.1	19.1
7	32.4 N	232.1	20.1	20.0	20.0	19.9	20.0	19.9	19.9	19.9	19.8	19.7	19.7
8	31.6 N	231.2	20.9	20.9	20.5	20.6	20.6	20.8	20.7	20.9	20.9	20.9	20.9
9	30.4 N	229.0	21.5	21.6	21.4	21.5	21.8	21.8	21.6	21.8	21.8	21.5	21.5
10	29.3 N	227.4	22.2	22.2	22.3	22.3	22.3	22.3	22.3	22.6	22.5	22.5	22.5
11	28.2 N	225.7	22.3	22.4	22.3	22.3	22.7	22.5	22.6	22.7	22.6	22.6	22.5
12	27.7 N	224.6	22.8	22.8	22.8	22.8	22.9	22.9	22.9	22.9	22.8	22.8	22.9
13[c]	27.0 N	222.3	23.8	23.8	23.8	23.8	23.8	23.7	23.8	23.8	23.8	23.8	23.8
14	26.7 N	220.9	23.9	24.0	24.0	23.9	23.9	23.9	23.8	23.8	23.8	23.8	23.8
15	26.5 N	219.4	24.0	24.1	24.1	24.0	24.0	23.9	23.8	23.9	23.9	23.9	24.2
16	26.2 N	217.9	24.8	24.8	24.8	24.7	24.8	24.8	24.8	24.7	24.6	24.5	24.5
17	25.1 N	216.4	25.2	25.2	25.2	25.2	25.2	25.2	25.2	25.2	25.2	25.2	25.2
18	24.0 N	214.4	25.4	25.4	25.3	25.3	25.3	25.5	25.5	25.4	25.3	25.3	25.3
19	23.4 N	211.3	25.6	25.6	25.5	25.6	25.6	25.6	25.6	25.6	25.8	25.9	26.2
Oct. 3[b]	23.5 N	200.4	26.3	26.4	26.3	26.4	26.4	26.4	26.4	26.6	26.7	26.7	26.7
4	26.4 N	199.5	26.3	26.3	26.2	26.2	26.3	26.3	26.2	26.4	26.4	26.4	26.6
5	29.1 N	198.8	25.6	25.7	25.7	25.7	25.7	25.6	25.7	25.8	25.8	25.8	25.7
6	31.7 N	199.0	25.2	25.1	24.6	24.6	24.8	24.6	24.3	24.3	24.3	24.3	24.3
7	32.8 N	199.3	24.2	24.3	24.3	24.3	24.1	24.0	24.1	24.1	24.1	24.0	24.1
11	33.7 N	208.3	22.6	22.8	22.8	22.9	22.8	22.8	23.2	23.3	23.3	23.2	23.2
12	33.3 N	212.3	22.7	22.6	22.5	22.8	22.7	22.7	22.7	22.7	22.7	22.3	22.3
13	33.4 N	214.6	22.0	22.1	22.0	22.1	22.3	22.1	22.1	22.3	22.3	22.3	22.3
14	33.6 N	216.9	22.2	22.3	22.3	22.4	22.4	22.3	22.2	21.9	22.1	22.0	21.9
15	31.8 N	219.3	22.4	22.4	22.5	22.5	22.4	22.3	22.3	22.3	22.3	22.3	22.2
16	29.1 N	220.8	21.9	22.5	22.1	22.6	22.8	22.8	22.8	22.8	22.8	22.8	22.8
17[b]	27.4 N	221.9	22.9	23.1	23.2	23.3	23.3	23.3	23.2	23.2	23.2	23.2	23.2
19	25.0 N	222.2	23.2	23.2	22.9	23.2	23.4	23.1	23.1	23.4	23.4	23.4	23.4
20	23.2 N	221.7	23.4	23.4	23.5	23.6	23.9	23.9	23.9	23.9	23.9	23.9	23.9
21	21.2 N	221.5	23.7	23.6	23.7	23.6	23.6	23.6	23.4	23.5	23.5	23.4	23.4
22	18.3 N	222.0	23.7	23.8	23.8	24.0	24.0	24.0	24.2	24.4	24.7	24.8	24.7
23	16.2 N	223.0	25.3	25.3	25.4	25.5	25.3	25.4	25.5	25.8	25.7	25.6	25.6
24	13.6 N	223.5	26.2	26.2	26.1	25.9	26.0	26.0	26.0	25.9	25.9	25.8	25.8
25	12.7 N	222.5	26.3	26.3	26.3	26.3	26.3	26.3	26.2	26.0	25.9	25.9	25.9
26	11.3 N	221.3	26.4	26.5	26.4	26.4	26.6	26.5	26.4	26.4	26.4	26.5	26.6
27	10.1 N	220.3	26.9	26.9	27.0	27.0	27.1	26.9	26.9	27.1	27.1	27.1	27.2
28	8.6 N	219.2	27.4	27.4	27.6	27.6	27.7	27.6	27.6	27.3	27.3	27.3	27.4
29	7.7 N	218.6	28.0	28.0	28.1	28.0	28.0	27.9	27.9	27.9	27.9	27.9	27.9
30	7.1 N	217.4	28.1	28.2	28.1	28.1	28.1	28.1	28.1	28.1	28.1	28.1	28.2
31	6.7 N	216.6	27.8	27.8	27.7	27.8	27.3	27.3	27.8	27.9	28.0	28.1	28.2
Nov. 1	5.8 N	215.3	28.1	28.2	28.1	28.1	28.1	28.0	28.0	28.0	28.0	28.0	28.0
2	4.9 N	213.2	28.0	27.8	27.8	27.9	27.9	27.9	27.8	27.8	27.8	27.7	27.7
3	4.3 N	210.7	26.6	26.6	26.6	26.8	27.2	27.3	27.6	27.6	27.7	27.7	27.7
4	3.0 N	210.2	27.7	27.7	27.7	27.8	27.7	27.7	27.6	27.6	27.5	27.5	27.6
5	0.8 N	208.5	27.5	27.4	27.3	27.3	27.2	27.1	27.1	26.8	26.3	26.3	26.3
6	1.8 S	207.6	26.7	26.8	26.8	26.8	26.8	26.8	26.8	26.8	26.8	26.8	26.8
7	4.9 S	206.6	27.3	27.3	27.3	27.3	27.3	27.3	27.3	27.3	27.3	27.3	27.3
8	6.6 S	204.9	27.6	27.7	27.8	27.9	27.9	27.9	27.8	27.8	27.8	27.9	27.9
9	8.1 S	203.1	28.1	28.1	28.3	28.3	28.3	28.3	28.3	28.3	28.3	28.3	28.3
10	9.0 S	201.9	28.3	28.4	28.4	28.3	28.3	28.3	28.3	28.3	28.2	28.2	28.2
11	9.4 S	200.9	28.3	28.3	28.4	28.4	28.3	28.3	28.3	28.3	28.3	28.4	28.5
12	10.3 S	198.9	28.3	28.3	28.4	28.4	28.4	28.4	28.4	28.4	28.4	28.3	28.4
13	11.0 S	198.0	28.6	28.6	28.5	28.5	28.6	28.6	28.5	28.5	28.5	28.4	28.3
14[d]	11.6 S	196.6	28.6	28.6	28.7	28.7	28.6	28.6	28.6	28.6	28.6	28.7	29.0

[a] Small, rapid fluctuations in temperature all during day; approaching San Francisco; overcast, light airs to calm. [b] Carnegie at San Francisco July 28-September 3; at Honolulu September 23-October 2. [c] Characteristic small, rapid fluctuations during late afternoon; light airs, clear to partly cloudy. [d] Highest

temperature, Carnegie, 1928-29--Concluded

local mean hour													Mean
11	12	13	14	15	16	17	18	19	20	21	22	23	
													°C
9.3	9.3	9.2	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.3	9.4	9.4	9.28
10.1	10.2	10.3	10.3	10.3	10.3	10.4	10.3	10.5	10.6	10.6	10.6	10.7	10.10
10.6	10.5	10.4	10.5	10.5	10.5	10.4	10.4	10.4	10.4	10.5	10.5	10.4	10.57
10.9	10.7	11.0	11.1	11.1	10.9	10.8	10.8	10.9	11.0	11.0	11.1	11.0	10.82
11.1	11.1	11.1	11.2	11.3	11.3	11.2	11.1	11.3	11.5	11.5	11.5	11.6	11.21
12.1	12.1	12.2	12.4	12.4	12.8	12.9	12.9	12.9	12.9	13.0	13.0	13.0	12.30
13.2	13.2	13.3	13.6	13.6	13.8	14.0	14.0	14.0	14.0	14.1	14.2	14.3	13.49
14.6	14.8	14.8	15.0	15.1	15.1	15.1	15.1	15.2	15.5	15.6	15.6	15.6	14.83
16.5	16.4	16.5	16.7	16.9	17.0	17.1	17.1	17.1	17.1	17.1	17.1	17.1	16.56
17.2	17.3	17.4	17.5	17.6	17.6	17.6	17.6	17.6	17.6	17.5	17.2	17.0	17.32
16.4	15.7	15.7	15.6	15.4	15.6	15.7	16.3	15.7	12.1	13.0	12.2	11.4	15.38
11.9	11.8	12.6	12.9	14.2	14.9	15.2	15.7	15.7	15.7	15.7	15.9	16.4	13.16
16.2	16.1	16.2	16.3	16.6	16.7	16.4	17.0	15.8	15.9	16.1	16.0	16.2	16.13
18.0	18.0	18.0	18.3	18.3	18.4	18.1	18.0	18.0	18.0	18.3	19.0	19.2	18.04
19.2	19.2	19.3	19.3	19.4	19.6	19.8	19.6	19.8	20.1	20.1	20.0	20.0	19.30
19.9	20.1	20.1	20.1	20.0	20.2	20.4	20.4	20.4	20.5	20.5	20.8	20.9	20.13
21.2	21.6	21.5	21.4	21.5	21.4	21.3	21.0	21.0	21.3	21.2	21.4	21.4	21.08
21.4	21.5	21.6	21.6	21.6	21.6	21.6	21.6	21.7	21.8	21.8	21.8	22.1	21.65
22.5	22.5	22.4	22.4	22.4	22.5	22.5	22.5	22.4	22.4	22.3	22.3	22.3	22.39
22.6	22.7	22.8	22.9	23.0	23.0	23.0	23.0	23.0	22.9	22.9	22.8	22.8	22.70
23.2	23.4	23.4	23.4	24.2	24.8	24.1	24.2	23.8	24.2	23.7	24.2	23.9	23.41
23.9	24.1	24.3	24.4	24.8	24.8	24.7	24.5	24.3	24.2	24.1	24.1	23.9	24.08
23.8	23.8	23.8	24.3	24.3	24.3	24.3	24.3	24.0	23.9	23.9	24.0	24.0	23.97
24.3	24.3	24.4	24.6	24.8	24.8	24.8	24.9	24.8	24.8	24.8	24.8	24.8	24.36
24.5	24.7	24.8	24.8	24.9	25.0	24.9	25.0	24.9	25.1	25.2	25.1	25.1	24.83
25.2	25.3	25.3	25.3	25.3	25.3	25.3	25.3	25.3	25.3	25.3	25.3	25.4	25.25
25.3	25.3	25.3	25.3	25.3	25.2	25.2	25.2	25.2	25.3	25.5	25.5	25.6	25.34
26.2	26.0	26.0	26.0	25.9	25.9	25.8	25.8	25.9	25.9	25.9	25.9	25.9	25.82
26.7	27.0	27.0	27.1	27.0	27.0	27.1	27.0	26.8	26.8	26.9	26.6	26.3	26.69
26.6	26.6	26.6	26.5	26.5	26.3	26.1	26.0	25.8	26.0	26.1	26.0	25.6	26.26
25.7	25.7	25.7	25.6	25.3	25.1	25.1	25.2	25.2	25.2	25.2	25.2	25.2	25.51
24.3	24.3	24.3	24.3	24.3	24.3	24.3	24.3	24.3	24.3	24.3	24.3	24.3	24.43
24.2	24.4	24.3	24.4	24.3	24.3	23.8	23.8	23.7	23.7	23.5	23.5	23.3	24.03
23.2	23.3	23.3	23.2	23.2	22.7	22.3	22.5	22.5	22.7	22.9	22.8	22.8	22.93
22.3	22.3	22.3	22.3	22.3	22.3	22.3	22.1	22.1	22.0	21.9	21.8	22.0	22.36
22.3	22.3	22.4	22.4	22.4	22.4	22.3	22.2	22.2	22.2	22.1	22.1	22.2	22.23
21.9	21.9	22.3	22.3	22.3	22.3	22.3	22.3	22.0	22.3	22.4	22.4	22.4	22.21
22.2	22.1	22.1	22.1	22.0	21.9	21.8	21.8	21.8	21.8	21.8	21.8	21.8	22.12
22.8	22.8	22.8	22.8	22.8	22.8	22.8	22.8	22.9	22.9	22.9	22.9	22.9	22.73
23.4	23.6	23.7	23.8	24.1	24.2	24.1	23.9	23.7	23.3	23.6	23.5	23.5	23.48
23.5	23.8	23.8	23.9	23.9	23.8	23.7	23.5	23.3	23.4	23.3	23.4	23.4	23.43
23.9	23.8	23.9	23.9	23.9	23.9	23.7	23.7	23.6	23.6	23.6	23.7	23.7	23.75
23.4	23.6	23.6	23.6	23.6	23.3	23.3	23.3	23.2	23.3	23.4	23.5	23.6	23.49
24.7	24.6	24.4	24.3	24.2	24.2	24.3	24.3	24.3	24.5	24.8	24.8	25.1	24.36
25.6	25.6	25.8	25.4	25.3	25.3	25.3	25.5	25.5	25.7	25.9	26.0	26.1	25.56
25.9	26.1	26.3	26.3	26.3	26.3	26.3	26.3	26.3	26.3	26.4	26.4	26.3	26.14
25.9	25.9	25.9	25.8	26.0	26.2	26.1	26.2	26.3	26.3	26.4	26.4	26.4	26.15
26.8	26.9	27.2	27.2	27.1	26.9	26.9	26.8	26.8	26.8	26.8	26.8	26.9	26.71
27.2	27.8	27.8	27.9	27.8	27.8	27.6	27.5	27.3	27.3	27.2	27.3	27.4	27.30
27.8	27.9	28.0	28.2	28.2	28.1	28.2	27.9	27.9	27.9	28.0	27.9	28.0	27.76
28.0	28.1	28.1	28.1	28.1	28.1	28.1	28.0	28.1	28.1	28.1	28.1	28.1	28.03
28.2	28.2	28.1	28.2	28.2	28.2	28.1	28.1	28.0	28.0	28.0	27.8	27.8	28.09
28.3	28.3	28.3	28.3	28.3	28.5	28.5	28.3	28.2	28.0	28.0	28.0	28.0	28.03
28.0	28.0	28.0	28.1	28.1	28.1	28.1	28.1	28.0	28.0	28.0	28.0	28.0	28.05
27.7	27.6	27.6	27.5	27.4	27.3	27.2	26.9	26.8	26.8	26.6	26.7	26.3	27.44
27.7	27.7	27.7	27.7	27.7	27.7	27.7	27.7	27.7	27.7	27.7	27.7	27.7	27.48
27.6	27.7	27.8	27.8	27.8	27.8	27.7	27.7	27.7	27.6	27.6	27.5	27.5	27.66
26.3	26.3	26.3	26.3	26.4	26.4	26.5	26.5	26.5	26.6	26.6	26.7	26.7	26.70
26.9	26.9	27.0	27.1	27.2	27.2	27.2	27.1	27.1	27.2	27.2	27.2	27.3	26.97
27.3	27.3	27.3	27.4	27.5	27.4	27.4	27.4	27.4	27.5	27.6	27.5	27.6	27.37
27.9	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	27.91
28.3	28.3	28.3	28.3	28.3	28.3	28.3	28.3	28.3	28.3	28.3	28.3	28.3	28.28
28.2	28.2	28.2	28.3	28.3	28.2	28.2	28.2	28.2	28.3	28.2	28.2	28.2	28.25
28.6	28.6	28.6	28.7	28.7	28.6	28.6	28.6	28.5	28.5	28.3	28.3	28.4	28.45
28.5	28.5	28.6	28.6	28.7	28.8	28.8	28.7	28.7	28.6	28.6	28.6	28.6	28.52
28.4	28.3	28.4	28.6	28.7	28.7	28.6	28.6	28.6	28.6	28.6	28.6	28.6	28.54
29.3	29.7	30.1	30.2	30.2	30.1	29.3	29.3	29.2	29.1	29.1	29.0	28.8	29.11

sea-surface temperature of cruise recorded at 14h and 15h; approaching Pago Pago; clear and calm.
Note: Carnegie at Pago Pago November 18-27, and destroyed by fire in Apia harbor November 29, 1929.

Table 80. Hourly values of vapor

From corrected Negretti-Zambra

Date	Latitude	Longitude east	Values in mm,										
			00	01	02	03	04	05	06	07	08	09	10
1928	°	°											
July 29	60.7 N	328.8	8.6	8.6	8.2	8.3	8.3	8.3	8.5	8.3	8.1	8.1	8.3
30	59.3 N	325.8	7.8	7.6	7.6	7.5	7.5	7.5	7.5	7.5	7.6	7.4	7.4
31	57.9 N	325.6	7.6	7.7	7.6	7.6	7.7	7.6	7.7	7.7	7.6	7.6	7.9
Aug. 1	58.3 N	324.2	8.9	8.9	9.0	9.0	9.1	9.0	9.0	8.9	9.0	9.0	9.2
2	58.3 N	321.3	7.7	8.0	8.0	8.0	7.9	7.8	8.1	8.1	8.1	8.1	8.7
3	57.9 N	314.5	7.6	7.6	7.7	7.7	7.6	7.6	7.6	7.4	7.4	7.6	7.6
4	54.5 N	311.0	7.6	7.8	7.7	7.7	7.7	7.8	7.8	7.6	7.7	7.8	7.7
5	51.6 N	310.4	7.5	7.5	7.0	7.6	7.6	7.6	7.2	7.2	7.1	7.4	7.5
6	48.4 N	311.8	7.1	7.0	7.0	6.9	6.9	6.9	7.0	6.9	7.0	7.5	7.8
7	45.9 N	312.1	8.9	9.4	9.4	9.4	9.4	9.4	9.3	9.4	9.4	9.4	9.3
8	43.2 N	313.0	10.1	10.1	10.1	10.0	10.0	9.8	10.1	10.1	10.3	10.8	10.6
9	42.2 N	312.7	11.5	11.1	11.1	10.9	10.9	11.1	10.9	11.0	11.4	12.0	12.3
10	39.8 N	311.1	14.0	14.3	14.2	14.2	14.7	15.2	16.3	16.8	17.2	18.6	19.1
11	38.6 N	311.2	19.6	19.7	19.5	20.3	20.2	20.3	20.1	20.1	20.1	21.0	20.8
12	37.0 N	311.6	20.7	20.4	20.0	19.9	19.9	19.9	19.9	20.1	20.2	20.8	20.8
13	36.8 N	313.4	21.0	20.3	21.0	20.7	20.3	19.7	20.2	21.0	21.1	21.4	21.4
14	35.2 N	315.6	21.7	21.6	21.4	21.7	21.2	21.2	21.7	22.4	22.2	22.1	22.4
15	33.6 N	317.7	22.3	22.6	21.5	22.3	22.5	22.3	22.4	22.6	22.6	22.4	22.4
16	31.2 N	318.8	22.5	22.5	22.5	22.4	22.4	22.4	21.0	22.4	22.8	22.8	23.1
17	29.8 N	319.4	22.0	22.2	21.6	21.7	22.0	21.7	20.8	20.6	21.6	21.6	21.6
18	27.9 N	320.5	20.2	20.2	20.2	19.8	20.1	19.8	19.9	19.9	19.9	20.4	20.6
19	25.7 N	321.0	19.8	19.9	19.7	19.9	19.5	19.7	20.2	20.6	20.4	20.0	21.4
20	24.0 N	320.4	19.0	18.1	18.0	18.1	17.9	17.3	17.8	19.6	19.1	16.6	19.2
21	21.8 N	320.4	19.8	19.6	19.7	19.0	19.4	19.2	19.4	19.5	19.7	20.0	19.9
22	19.2 N	321.5	19.4	19.6	19.9	20.0	20.3	20.3	20.3	20.1	20.8	21.0	21.1
23	16.6 N	322.2	20.2	20.0	20.4	21.0	20.7	20.5	20.7	21.5	21.4	21.5	22.0
24	15.8 N	322.1	21.4	21.2	21.0	20.5	21.6	21.3	21.3	21.4	21.3	21.5	21.9
25	14.9 N	321.8	21.3	21.3	20.9	21.4	21.6	21.1	21.6	23.2	24.9	22.5	22.8
26	13.9 N	322.0	21.8	21.0	20.6	21.7	21.5	21.4	21.9	21.6	21.6	22.4	22.9
27	13.4 N	322.0	21.8	22.0	21.8	21.8	21.5	21.3	21.5	20.7	21.6	21.6	22.0
28	11.9 N	322.2	21.4	22.0	22.2	21.7	21.7	21.7	21.8	22.3	22.4	22.5	22.7
29	10.8 N	322.6	21.6	21.5	21.2	21.4	21.4	21.7	21.5	21.4	21.7	21.9	22.7
30	9.5 N	322.8	21.4	21.6	21.5	21.4	21.0	20.8	21.5	21.6	21.5	21.8	22.2
31	8.2 N	323.8	20.5	20.6	20.5	21.3	21.6	21.3	21.2	21.3	21.4	21.5	22.6
Sep. 1	9.4 N	323.3	20.5	20.6	20.6	20.5	20.4	20.4	20.2	20.3	21.2	20.2	20.3
2	9.8 N	323.3	20.6	20.4	20.4	20.8	21.0	21.1	21.3	21.2	21.2	21.0	21.8
3	11.2 N	322.9	21.3	21.8	21.9	21.2	21.3	21.2	21.7	21.4	21.1	21.7	22.2
4	11.4 N	322.0	21.5	21.5	21.8	21.6	21.9	21.8	22.2	22.4	22.2	22.4	23.2
5	11.6 N	319.2	22.0	21.7	21.1	21.5	21.3	21.3	21.3	21.2	21.0	22.0	22.2
6	11.7 N	317.4	21.3	20.8	20.8	20.8	20.6	20.8	21.0	21.1	20.9	20.9	21.7
7	11.3 N	31.58	21.3	21.3	21.5	20.4	21.1	20.7	21.2	21.1	21.2	22.0	22.1
8	11.6 N	314.9	20.6	20.7	20.8	21.0	20.8	20.7	21.1	21.6	21.7	21.7	21.7
9	11.8 N	313.9	21.1	21.2	21.1	21.1	21.3	21.3	21.3	21.9	21.9	21.7	22.0
10	12.2 N	312.2	21.1	21.0	21.5	22.4	22.7	21.3	22.7	21.9	21.9	22.6	22.6
11	13.2 N	310.3	22.5	19.8	21.4	21.9	22.2	22.0	22.2	20.9	20.8	21.9	22.4
12	13.2 N	309.5	21.5	21.7	21.7	21.1	21.1	21.3	21.7	21.5	22.2	22.2	23.1
13	13.3 N	307.6	21.7	22.0	21.1	20.4	21.0	20.9	21.0	20.8	21.4	21.1	21.2
14	13.0 N	305.7	19.2	19.2	19.5	19.4	19.2	19.4	18.8	19.3	19.4	18.7	19.6
15	12.9 N	303.7	20.2	20.6	20.3	20.6	20.3	20.6	20.5	20.6	20.7	21.7	22.1
Oct. 2	14.7 N	298.6	20.9	21.1	21.1	21.1	21.0	21.0	21.1	21.3	21.4	22.2	20.9
3	14.8 N	296.4	22.5	22.3	22.4	22.5	22.0	22.5	22.5	22.4	22.5	23.1	23.1
4	15.0 N	293.9	21.7	21.4	22.6	22.1	22.1	21.8	22.6	22.5	21.5	21.1	21.7
5	15.3 N	291.8	22.2	21.8	22.0	21.0	21.8	21.1	22.6	22.5	22.3	22.1	22.4
6	15.2 N	288.8	22.7	22.9	22.5	22.7	22.9	22.9	23.0	23.9	23.8	23.4	23.4
7	14.5 N	286.0	23.1	23.1	22.9	23.3	23.9	23.3	23.7	23.1	24.0	23.8	24.0
8	13.2 N	283.6	23.2	23.6	23.2	23.2	23.6	21.7	23.2	23.6	23.7	23.9	24.1
9	11.4 N	281.4	22.8	22.8	23.2	23.6	23.2	24.0	24.3	24.3	24.2	24.2	24.1
10	10.3 N	280.7	22.8	22.7	23.2	22.1	22.5	23.4	25.5	23.0	23.2	23.2	23.1
26	6.7 N	280.1	24.7	24.7	23.5	23.5	23.3	24.5	24.5	23.9	21.5	21.3	21.4
27	5.7 N	279.9	23.8	23.9	21.2	23.0	23.2	21.7	21.5	21.6	21.9	22.6	22.7
28	4.3 N	280.2	22.6	22.5	22.4	22.4	22.8	22.9	22.8	22.8	22.8	22.7	22.3
29	4.1 N	280.1	20.8	20.7	20.9	19.6	20.1	20.8	20.8	19.8	21.8	22.1	21.9
30	2.9 N	279.9	21.9	21.8	22.0	21.9	21.6	21.1	21.3	21.2	21.6	21.6	21.4
31	4.5 N	278.1	21.0	21.0	21.1	21.2	21.2	21.1	21.2	21.6	21.7	21.5	21.5
Nov. 1	6.1 N	276.0	22.1	21.4	21.5	21.3	21.6	22.1	21.5	21.6	22.2	22.5	22.5
2	4.6 N	277.7	22.0	21.8	21.8	22.2	23.3	24.5	24.9	22.5	22.3	22.0	21.8
3	3.7 N	278.5	20.0	20.3	20.9	20.6	20.9	21.0	20.9	20.9	21.2	21.2	21.3
4	2.5 N	278.9	19.6	19.4	19.5	19.5	19.3	19.3	19.6	19.2	19.6	19.6	18.9
5	1.6 N	279.2	19.0	18.4	18.7	18.6	19.1	18.6	18.5	19.1	19.1	19.1	19.0

pressure, Carnegie, 1928-29

wet- and dry-bulb readings

local mean hour													Mean
11	12	13	14	15	16	17	18	19	20	21	22	23	
													°C
8.4	8.5	8.6	8.6	8.6	9.0	8.9	8.5	8.5	8.6	8.6	8.4	8.2	8.46
7.3	7.4	7.5	7.6	7.7	7.9	8.0	7.8	7.8	7.7	7.7	7.7	7.7	7.61
8.2	8.6	8.5	9.0	9.0	9.0	8.8	8.9	8.9	8.9	8.9	8.8	8.8	8.28
9.0	8.7	8.7	8.7	8.2	8.5	8.5	8.4	8.1	7.9	7.9	7.9	7.9	8.64
8.6	8.7	8.6	8.8	8.6	8.3	8.2	8.4	8.4	8.4	8.4	8.2	8.8	8.29
7.7	7.7	7.8	7.8	7.8	7.8	7.7	7.7	7.7	7.7	7.8	7.8	7.7	7.67
7.6	7.6	7.6	7.7	7.6	8.0	7.7	7.5	7.4	7.6	7.5	7.5	7.6	7.66
7.3	7.3	7.4	7.6	7.5	7.5	7.5	7.5	7.2	7.1	7.0	7.1	7.1	7.34
8.1	8.5	8.7	8.6	8.5	8.8	8.7	8.8	8.8	8.7	8.8	8.8	8.9	7.95
9.5	9.5	10.0	9.8	10.0	9.7	10.0	10.1	10.3	10.0	10.0	10.2	10.2	9.67
11.2	11.2	11.1	11.7	11.8	11.7	11.6	11.7	11.8	11.3	11.3	11.4	11.3	10.88
12.1	12.2	12.2	12.0	12.1	12.2	12.4	12.2	12.3	13.0	13.5	14.3	14.5	12.05
20.2	19.9	19.2	19.1	18.8	19.0	19.4	19.8	19.4	18.9	18.9	18.9	19.1	17.72
20.8	20.8	20.9	21.1	21.0	21.0	21.1	21.1	21.4	21.3	21.4	21.4	21.2	20.68
20.8	21.2	22.0	21.9	22.3	21.9	22.3	22.7	20.9	21.1	21.0	21.0	20.9	20.94
22.4	22.6	22.6	22.4	22.6	22.6	23.6	23.3	23.0	22.4	22.2	22.1	22.1	21.75
22.6	22.5	24.2	23.0	23.3	23.5	23.5	22.6	22.6	22.5	22.6	22.5	22.4	22.39
23.1	22.8	23.6	23.8	23.9	23.6	23.9	23.5	22.7	22.8	22.5	22.6	22.6	22.80
23.4	23.6	23.7	23.6	23.7	23.7	23.7	23.5	23.3	22.5	22.1	22.2	22.2	22.83
21.7	21.9	23.0	21.7	21.7	21.3	20.7	20.2	20.3	20.3	20.2	20.2	20.4	21.29
20.6	21.0	20.7	20.4	22.0	21.1	20.4	20.1	20.0	20.3	19.7	20.1	19.8	20.30
21.0	20.9	19.8	19.9	19.8	19.9	20.2	19.9	19.4	19.3	19.6	18.9	19.5	19.97
19.2	19.2	19.2	17.6	18.8	19.1	19.5	19.1	18.1	19.3	19.8	19.1	19.3	18.67
19.7	19.7	19.9	19.6	19.4	19.6	20.1	20.0	19.8	19.7	19.7	19.5	19.6	19.65
21.3	21.4	21.0	21.0	21.2	21.2	21.5	21.7	21.4	21.5	21.2	21.0	21.4	20.82
22.0	21.2	21.3	21.5	21.2	21.2	21.2	21.2	21.2	21.1	21.1	21.1	21.1	21.10
22.1	22.1	21.8	21.5	21.9	21.3	21.6	21.0	21.0	21.0	21.0	21.2	21.2	21.38
22.7	22.9	22.3	22.2	22.3	22.1	22.9	21.8	21.7	21.9	21.8	22.0	21.8	22.12
22.7	22.9	22.3	22.8	22.7	22.2	22.8	21.4	22.0	22.6	22.5	21.7	21.7	22.03
22.5	22.3	22.3	22.7	22.7	21.9	21.9	22.1	21.8	21.5	21.3	21.3	21.2	21.80
22.7	23.4	22.7	22.9	22.7	22.4	22.3	21.8	22.2	21.7	21.6	21.3	22.0	22.17
22.3	22.8	22.6	22.2	22.1	22.1	21.8	21.4	20.7	20.4	21.3	21.3	21.1	21.67
22.2	22.5	22.5	22.3	22.3	21.9	21.3	21.2	21.3	21.3	21.5	21.5	20.8	21.62
21.8	21.9	21.9	21.6	21.3	21.7	21.5	21.5	21.6	21.4	21.2	21.1	20.8	21.38
21.2	21.4	21.7	21.4	21.2	21.4	20.3	20.6	20.2	20.2	20.3	20.2	20.6	20.66
22.2	22.4	22.3	21.8	21.7	21.9	21.7	21.6	21.4	21.4	21.7	20.5	20.8	21.34
22.2	22.3	22.4	22.4	22.5	22.4	21.6	21.6	20.3	21.3	21.7	21.5	21.5	21.68
23.4	23.3	23.3	23.3	22.5	22.6	22.5	22.4	22.2	22.2	21.3	21.8	21.5	22.28
22.4	21.3	21.9	21.9	21.3	20.9	21.0	20.8	21.1	21.0	21.0	20.9	21.1	21.38
20.0	21.8	22.2	22.1	21.5	21.7	22.2	21.3	22.1	21.4	21.2	20.6	21.1	21.24
22.3	22.1	22.0	22.0	22.3	22.1	21.0	21.4	21.2	21.1	20.9	20.9	21.1	21.43
22.1	21.7	21.5	21.3	20.9	20.7	20.7	20.6	20.7	21.0	20.8	21.0	21.4	21.12
22.1	22.6	22.9	22.0	22.2	22.3	22.1	21.0	22.3	21.6	19.9	21.5	22.0	21.68
22.5	22.4	22.6	22.8	22.7	22.4	22.4	22.5	21.3	21.4	22.2	22.1	22.3	22.14
22.5	22.8	22.9	23.4	22.4	22.6	22.5	22.0	22.3	21.8	22.0	21.6	22.2	22.04
22.7	22.5	22.8	21.9	22.0	22.0	21.4	20.9	21.0	21.0	21.2	21.2	22.5	21.76
20.9	20.7	20.4	20.9	20.9	20.7	19.4	20.4	19.3	19.9	19.8	20.0	19.5	20.64
19.6	19.8	19.7	19.7	19.9	20.0	19.6	19.4	19.2	19.6	20.0	20.0	20.6	19.53
21.8	21.8	21.8	21.9	22.0	21.9	22.1	22.0	21.3	21.3	21.7	22.4	22.1	21.35
21.1	21.1	23.1	22.3	22.2	22.5	22.4	22.4	22.3	22.3	22.3	22.2	22.3	21.73
22.9	23.5	23.9	23.5	22.4	23.0	20.3	20.1	19.8	19.7	20.2	21.0	21.0	22.04
20.6	20.4	21.5	21.1	22.8	22.7	22.8	22.8	22.5	21.1	21.6	22.3	22.3	21.90
22.3	22.4	22.5	22.2	22.4	20.6	22.3	23.0	22.4	22.5	23.0	22.8	22.8	22.21
23.3	23.6	23.5	23.6	23.8	23.7	23.8	23.2	23.9	23.3	23.1	23.5	23.5	23.33
23.7	24.0	23.4	23.9	22.8	24.0	23.6	24.1	23.7	23.7	23.9	23.3	23.5	23.58
24.3	24.0	24.0	24.0	24.1	22.8	23.1	22.7	22.7	23.1	23.3	23.5	23.0	23.40
23.9	24.1	24.2	24.4	24.1	23.9	23.6	24.4	22.9	22.3	22.0	21.5	22.2	23.51
22.9	23.5	23.7	22.6	22.6	22.7	22.4	22.4	22.5	22.6	22.4	21.8	22.5	22.79
22.7	23.8	24.0	24.0	23.8	23.9	24.0	23.8	24.0	24.2	24.7	23.7	23.6	23.62
22.7	22.3	22.1	22.5	21.7	21.5	21.2	21.2	22.5	22.3	22.2	22.4	22.5	22.26
20.0	20.6	20.7	21.0	21.1	21.2	21.1	20.3	20.0	20.1	20.2	21.0	20.7	21.54
22.0	22.5	22.5	22.8	22.5	22.8	22.3	22.6	22.2	22.1	22.3	22.2	21.4	21.65
21.3	21.1	21.3	21.1	20.9	20.8	20.8	21.0	21.0	21.3	21.0	21.1	21.5	21.32
22.2	22.1	21.8	21.9	21.7	21.7	21.8	21.6	21.1	21.6	22.1	22.1	22.1	21.58
22.3	22.1	22.1	22.2	21.9	21.9	22.0	21.9	22.3	22.1	22.3	22.0	22.2	21.98
21.8	21.6	22.1	21.4	21.4	21.8	21.6	21.4	20.9	20.3	19.8	19.7	20.2	21.62
20.7	21.4	21.0	20.9	20.9	20.6	20.6	20.9	20.4	20.4	20.2	19.9	20.2	20.72
18.9	18.9	19.1	19.0	19.2	18.7	19.0	19.2	18.9	19.3	19.1	18.8	18.7	19.18
18.8	18.7	18.8	17.9	18.0	18.4	18.2	18.1	18.0	17.0	17.0	16.8	16.7	18.32

Table 80. Hourly values of vapor

Date	Latitude	Longitude east	Values in mm, 00	01	02	03	04	05	06	07	08	09	10
1928	°	°											
Nov. 6	0.8 N	278.8	16.7	16.7	16.5	16.7	16.5	16.3	17.5	17.6	18.2	18.3	18.5
7	0.5 S	278.0	16.9	16.8	16.6	16.6	17.0	16.9	16.9	17.1	17.3	17.5	17.3
8	1.5 S	277.7	15.6	15.6	15.5	15.5	15.5	15.2	15.3	15.3	15.3	15.3	15.3
9	1.3 S	275.2	14.0	13.5	14.2	13.7	14.3	14.3	14.3	14.4	14.4	14.4	14.5
10	1.6 S	273.0	13.9	13.9	14.1	13.9	14.0	14.1	14.4	14.9	14.9	15.0	14.7
11	1.9 S	271.0	13.6	13.5	13.3	13.7	13.5	12.4	12.5	13.6	14.2	13.5	13.4
12	1.3 S	268.7	12.8	12.7	12.7	12.7	12.7	12.7	12.9	13.7	13.2	13.3	13.2
13	1.5 S	266.9	12.8	13.0	12.9	12.7	13.1	12.8	12.9	13.8	13.7	13.7	13.8
14	1.8 S	265.7	13.1	13.7	13.2	13.2	13.0	12.9	12.8	14.2	13.9	13.8	13.8
15	2.5 S	264.2	14.4	14.4	14.4	14.7	14.6	14.4	14.5	15.0	15.1	15.1	15.0
16	3.1 S	261.8	15.2	15.2	15.2	15.2	15.8	15.4	15.7	16.2	16.1	15.5	16.0
17	3.3 S	260.2	16.7	16.7	16.7	16.8	16.6	16.6	16.1	16.3	15.7	15.7	14.8
18	4.0 S	257.4	15.6	15.1	15.6	15.7	15.8	16.0	16.0	16.1	14.9	13.8	15.5
19	4.6 S	254.5	13.5	14.1	15.2	15.7	15.7	13.9	14.1	15.9	15.9	14.9	15.6
20	7.0 S	253.1	16.0	15.6	15.7	15.7	15.6	15.5	16.0	16.1	15.7	16.0	16.6
21	9.2 S	251.6	16.8	16.9	16.9	17.0	18.4	20.1	16.9	17.0	16.7	16.6	16.8
22	12.0 S	249.8	16.6	16.6	16.8	16.8	17.5	18.1	17.5	16.8	16.6	16.6	16.9
23	14.2 S	248.1	15.9	16.1	16.3	16.5	16.6	16.4	15.2	16.8	16.3	16.8	16.4
24	16.7 S	247.0	17.0	16.8	16.8	16.7	16.9	16.8	15.5	15.3	16.4	16.4	16.5
25	19.2 S	245.9	15.8	15.9	16.2	16.5	16.4	16.6	16.7	16.5	16.4	16.2	16.0
26	21.6 S	245.6	15.9	16.0	16.0	16.0	16.0	16.0	16.0	16.0	14.7	16.0	15.4
27	23.3 S	245.2	16.1	16.0	15.9	16.0	16.8	16.9	16.9	15.5	16.7	16.5	16.1
28	24.8 S	244.7	16.7	16.4	16.9	17.6	17.4	16.3	16.8	17.4	16.8	16.8	16.4
29	26.6 S	244.7	15.8	16.0	15.9	16.3	15.5	15.6	15.5	15.2	15.5	15.4	15.6
30	28.1 S	244.9	16.0	15.9	16.0	14.0	15.6	16.3	15.5	14.7	15.1	15.1	15.9
Dec. 1	29.2 S	245.2	15.4	15.3	14.8	14.6	14.6	14.7	14.8	15.3	15.4	15.6	15.4
2	30.6 S	245.7	14.8	14.8	14.4	14.2	14.3	14.5	14.4	14.4	15.1	15.1	15.0
3	31.5 S	247.3	15.4	15.4	15.7	15.7	15.9	15.8	15.8	15.7	15.4	15.5	15.6
4	31.4 S	249.9	15.9	15.9	16.0	16.0	15.9	16.0	16.3	16.4	16.8	16.6	16.7
5	28.9 S	251.3	17.1	17.0	17.5	17.4	17.7	17.5	17.6	17.7	17.5	17.5	17.5
13	28.2 S	250.8	16.9	15.9	15.8	16.0	15.7	16.7	17.0	16.8	16.0	16.3	16.5
14	29.4 S	251.1	16.5	15.5	15.8	15.5	15.7	16.5	15.8	15.9	15.7	15.0	15.5
15	31.1 S	250.5	14.0	14.1	14.2	13.9	14.0	13.8	14.0	14.2	13.9	13.9	14.0
16	32.0 S	249.1	12.5	12.6	11.8	12.7	12.2	12.9	12.7	12.4	12.3	12.2	12.3
17	31.8 S	250.6	14.5	15.5	15.5	15.7	15.8	15.7	11.7	11.6	11.4	11.7	12.5
18	31.9 S	251.0	11.8	11.8	11.8	11.7	11.6	11.5	11.5	12.2	12.2	12.4	12.4
19	32.5 S	252.6	14.2	14.3	14.5	14.4	14.6	14.5	15.1	14.9	14.8	14.7	14.5
20	34.0 S	253.4	12.4	11.4	13.2	13.7	14.1	14.4	14.7	15.1	15.0	15.0	15.5
21	35.3 S	254.6	16.0	15.9	15.9	15.9	15.9	15.8	16.0	14.9	15.5	15.6	15.5
22	36.9 S	255.9	15.0	14.6	14.1	14.0	14.1	14.1	14.1	14.1	14.2	14.4	14.1
23	38.7 S	257.1	14.0	14.0	13.8	13.9	13.7	13.7	13.5	13.4	13.3	13.1	13.1
24	39.9 S	259.0	12.2	12.4	12.4	12.5	12.5	12.6	12.6	12.4	12.2	12.5	12.7
25	40.3 S	261.0	11.0	10.7	10.8	10.8	10.6	10.5	10.5	10.6	10.7	10.8	10.9
26	40.4 S	262.5	11.7	11.7	11.7	11.7	11.9	11.9	12.1	12.3	11.8	12.0	12.7
27	39.9 S	263.7	12.2	12.2	12.2	12.3	12.1	11.9	12.5	12.5	12.8	12.5	12.6
28	38.4 S	265.8	12.6	12.7	12.5	12.7	12.6	12.8	12.9	13.1	12.9	13.1	13.3
29	36.6 S	267.0	12.9	13.0	12.9	13.0	12.9	12.4	12.4	12.6	12.3	12.9	12.8
30	34.5 S	268.2	12.6	12.4	12.2	12.2	12.3	12.4	12.1	12.7	12.8	12.9	12.7
31	32.5 S	270.0	12.1	12.3	12.2	12.2	12.1	12.6	12.4	12.9	12.8	13.0	13.8
1929													
Jan. 1	32.2 S	270.9	12.8	12.8	12.7	12.7	12.9	12.8	13.3	13.4	13.9	13.9	13.8
2	31.9 S	271.1	12.3	12.2	12.1	12.2	12.3	12.2	12.1	12.7	13.0	13.5	14.3
3	31.9 S	271.7	12.1	12.0	11.5	11.7	11.4	11.3	11.6	11.8	12.4	12.1	11.9
4	31.8 S	272.7	11.9	12.0	11.9	11.7	11.9	11.5	11.3	11.1	11.3	11.3	11.0
5	31.0 S	273.4	12.1	12.2	12.2	12.4	12.4	12.7	13.2	13.2	13.3	13.5	13.6
6	28.9 S	274.7	14.2	14.2	12.9	14.1	13.6	14.0	14.3	14.4	14.4	14.6	14.8
7	27.0 S	276.0	13.6	13.6	13.5	13.0	12.7	12.7	12.7	12.9	12.8	12.4	12.3
8	25.0 S	277.8	11.7	12.0	11.5	11.0	10.1	10.7	11.0	11.0	11.2	11.1	11.0
9	23.1 S	278.8	12.4	12.1	12.3	12.6	12.4	12.5	12.9	13.1	13.2	13.6	13.3
10	21.4 S	279.5	13.6	12.7	13.1	13.2	13.3	13.1	13.2	13.2	13.5	13.4	13.4
11	19.1 S	280.7	13.5	12.7	12.6	12.5	13.4	13.5	13.8	13.9	13.9	12.5	12.8
12	16.7 S	281.4	13.2	12.9	12.3	12.8	12.9	12.8	13.1	13.4	13.0	13.0	13.8
13	14.1 S	282.1	15.3	15.3	15.3	15.5	15.7	15.5	15.6	15.2	15.8	15.6	16.2
14	12.3 S	282.8	16.0	15.8	15.8	15.9	16.0	15.7	15.8	15.8	15.9	16.1	16.2
Feb. 6	11.9 S	281.4	17.0	16.8	15.7	16.4	16.2	16.5	16.6	16.6	17.0	17.0	17.3
7	10.2 S	280.1	18.2	17.9	18.0	18.0	17.8	17.2	17.7	17.8	18.6	18.4	18.3
8	10.0 S	277.8	18.8	18.8	19.0	19.0	18.8	19.1	19.3	19.1	18.9	18.8	18.9
9	10.4 S	275.8	17.8	17.9	17.9	17.9	17.7	17.8	17.7	17.7	17.9	18.0	18.3
10	10.8 S	275.0	16.2	16.4	16.4	16.1	17.2	17.1	17.4	17.5	17.3	17.6	17.4
11	10.7 S	274.1	17.1	17.1	17.4	17.5	17.3	17.3	17.3	17.4	17.5	18.1	17.9
12	11.0 S	272.6	17.1	17.3	17.0	17.0	16.8	17.0	16.3	17.3	17.2	17.2	17.1
13	12.6 S	270.3	16.4	16.5	16.4	16.4	16.6	16.6	16.9	16.5	17.3	16.7	16.8
14	14.4 S	267.8	16.7	16.6	16.3	16.0	15.9	15.4	16.2	16.2	16.4	16.4	16.4

pressure, Carnegie, 1928-29--Continued

local mean hour													Mean
11	12	13	14	15	16	17	18	19	20	21	22	23	
													°C
18.2	18.3	18.3	18.1	18.1	18.2	18.0	17.1	17.4	17.3	16.9	17.4	17.1	17.50
17.3	16.9	16.9	16.9	16.8	16.9	16.9	16.3	16.2	16.1	16.0	16.1	15.9	16.75
15.4	15.3	15.0	14.9	14.5	14.4	14.3	14.2	14.1	14.0	14.0	13.9	13.9	14.89
14.6	14.4	14.7	14.6	14.6	14.5	14.5	14.4	14.3	14.1	14.1	14.1	13.9	14.28
14.9	14.8	14.8	14.7	14.5	13.7	14.5	14.0	14.1	13.6	13.6	13.0	12.9	14.20
13.3	13.4	13.3	13.3	13.3	13.4	13.4	13.6	13.7	13.7	13.4	13.4	13.1	13.40
13.2	12.8	14.0	13.3	14.8	13.1	13.2	13.4	13.3	12.9	13.1	13.0	13.2	13.16
13.8	13.7	13.9	14.3	14.1	13.7	14.0	14.1	13.9	13.9	13.1	13.9	12.7	13.51
14.0	14.1	14.3	14.0	13.5	13.9	14.2	14.1	14.3	14.3	14.3	14.4	14.4	13.81
15.0	15.0	14.9	14.9	14.9	15.1	14.9	14.9	14.9	15.0	15.0	15.0	15.0	14.84
15.8	16.1	16.2	15.9	16.3	16.0	16.1	16.2	16.3	16.3	16.3	16.5	16.5	15.92
14.7	14.3	14.3	15.4	15.5	15.6	14.6	14.7	14.7	15.1	16.0	15.8	14.8	15.59
15.4	15.8	15.5	16.3	15.5	16.2	15.6	15.5	15.6	14.2	15.6	15.5	15.2	15.50
15.8	15.5	15.2	15.2	15.8	16.7	16.5	16.6	16.2	16.2	16.0	16.0	16.0	15.51
16.9	16.8	16.4	16.6	17.0	17.0	16.9	16.9	16.8	16.8	16.6	16.5	16.8	16.35
16.3	16.1	16.8	16.8	16.8	16.6	16.8	16.7	16.7	16.7	16.7	16.4	16.3	16.91
16.4	16.6	16.3	15.9	16.6	16.4	16.7	16.4	16.7	16.6	16.6	16.8	16.7	16.73
15.0	16.4	16.6	17.0	16.7	16.7	16.9	17.1	16.9	16.8	17.2	16.5	16.1	16.47
16.3	16.4	16.4	15.6	15.9	15.4	16.8	15.9	16.6	16.4	16.6	16.4	16.5	16.35
16.0	16.2	15.6	16.6	16.0	16.0	15.5	15.5	15.7	15.5	15.5	15.5	15.5	16.01
15.8	15.8	15.5	15.6	15.8	15.3	15.7	16.7	16.9	16.3	16.3	15.7	15.8	15.88
16.6	16.7	16.6	16.5	16.4	16.4	16.6	16.8	16.5	16.1	16.3	16.6	16.2	16.40
16.5	16.4	15.8	15.9	15.7	15.5	14.9	15.1	15.3	15.5	14.9	15.3	15.5	16.16
15.5	15.8	16.7	16.5	15.9	15.6	16.2	15.9	15.8	15.7	15.6	16.0	16.0	15.81
15.8	15.7	15.5	16.2	15.5	15.2	15.5	15.8	15.6	15.4	15.3	15.5	15.3	15.52
15.5	15.3	15.2	15.1	14.7	14.1	14.1	14.3	14.4	14.5	14.3	15.1	15.0	14.90
15.2	15.0	15.0	15.3	15.5	15.5	15.4	15.1	15.3	15.3	15.6	15.6	15.6	15.02
15.6	15.5	15.5	15.6	15.6	15.5	15.6	15.6	15.5	15.5	15.5	15.7	15.9	15.60
17.0	16.9	17.1	17.0	17.3	17.3	17.3	17.2	17.3	17.1	17.2	17.2	17.0	16.72
17.7	17.6	17.8	17.8	17.7	17.9	17.9	17.7	17.5	18.0	17.5	17.5	17.6	17.59
16.5	16.5	16.1	16.3	16.6	16.2	15.5	16.4	15.5	15.1	15.9	15.9	16.8	16.20
15.5	15.0	15.9	16.3	16.5	16.6	15.7	15.3	15.1	14.3	14.2	14.1	14.0	15.50
13.9	13.7	13.6	13.9	13.6	13.3	13.7	13.1	13.2	13.1	13.1	13.1	12.3	13.65
12.0	12.1	11.9	11.9	11.9	12.0	12.1	12.1	11.7	11.7	13.1	15.3	15.2	12.48
12.3	12.3	12.1	12.4	12.3	12.2	12.2	11.8	11.4	11.4	11.4	11.4	11.5	12.76
12.4	12.5	12.5	12.6	13.1	12.6	12.8	12.7	13.4	13.4	13.7	13.7	14.0	12.51
14.4	14.4	14.2	13.8	13.9	13.9	14.0	14.0	14.0	14.3	14.1	13.1	12.6	14.22
15.7	16.2	16.3	16.4	16.4	16.2	16.0	15.9	15.8	15.8	15.9	15.9	15.9	15.12
15.5	15.5	15.6	15.7	15.9	16.3	15.9	15.8	15.2	15.0	15.0	15.1	15.0	15.60
14.1	14.0	14.2	14.2	14.2	14.2	14.0	14.0	14.0	13.8	14.0	14.1	14.0	14.15
13.0	13.0	13.1	13.1	13.2	13.1	13.0	12.9	12.7	12.6	12.6	12.4	12.3	13.19
12.7	12.4	12.3	12.0	11.7	11.9	11.7	11.7	11.3	11.4	11.3	11.3	11.2	12.08
10.9	11.3	11.1	10.7	10.5	10.5	10.7	11.5	11.7	11.8	11.8	11.6	11.8	10.99
13.4	13.4	11.5	14.1	14.7	11.5	12.2	11.7	11.6	11.7	11.9	12.0	12.2	12.23
12.5	12.5	12.7	12.4	12.2	12.2	12.3	11.8	11.7	12.0	12.0	12.2	12.3	12.28
13.5	13.5	13.5	13.5	13.3	13.2	13.4	13.4	13.0	13.1	13.3	13.0	12.9	13.08
12.9	13.1	13.0	12.9	13.2	13.1	13.0	13.0	13.2	12.9	12.5	12.5	12.5	12.83
12.3	12.1	12.7	12.2	12.7	12.5	12.0	12.0	12.4	11.9	12.1	11.9	12.3	12.35
13.5	13.6	13.5	13.0	12.5	12.5	12.3	13.3	12.8	13.0	13.1	13.0	13.0	12.81
13.6	14.1	13.7	13.9	14.1	13.5	13.6	12.8	13.6	13.0	13.1	12.4	12.3	13.28
13.9	13.5	13.5	14.0	13.9	13.5	13.3	13.0	13.1	12.7	12.7	12.6	12.4	12.96
12.0	12.6	12.6	12.4	12.5	12.9	12.7	12.4	12.4	12.3	12.3	12.1	12.2	12.13
11.5	11.6	11.8	11.8	11.8	11.6	12.2	12.3	11.9	12.0	11.9	11.9	12.0	11.72
14.1	14.3	14.7	14.1	14.5	14.6	14.7	14.8	14.4	14.2	14.2	14.3	14.2	13.66
14.5	14.4	14.6	15.0	14.5	14.7	14.7	14.3	14.4	14.6	14.4	14.1	13.6	14.30
12.1	12.7	13.2	12.5	12.8	12.6	13.0	12.6	12.8	12.6	12.6	12.1	12.3	12.75
10.8	11.9	11.9	12.2	13.4	13.4	13.3	12.8	12.4	12.4	12.3	12.5	12.5	11.84
13.2	13.8	14.4	14.5	13.7	14.4	13.3	13.8	13.1	13.6	13.6	12.8	13.3	13.25
13.7	13.6	13.8	13.9	13.6	13.4	13.1	13.1	13.4	13.3	12.8	13.2	13.4	13.33
13.0	13.0	13.2	13.6	13.6	13.1	13.6	13.4	13.0	13.4	13.2	13.1	13.0	13.22
13.5	14.9	13.8	14.7	15.0	15.3	15.0	14.7	14.6	15.2	15.6	15.6	15.4	14.02
16.4	16.4	16.4	16.1	16.7	16.4	16.5	16.5	16.1	16.1	16.1	16.2	16.1	15.96
16.3	16.3	16.4	16.4	16.1	15.9	15.2	14.9	14.3	14.5	14.5	14.2	14.4	15.60
17.5	17.4	18.2	18.4	18.3	18.6	18.4	17.8	18.0	18.0	18.2	18.1	18.3	17.43
18.6	18.8	18.7	18.7	18.8	18.9	19.3	18.8	18.8	18.9	18.7	18.7	19.0	18.44
19.3	19.4	19.6	19.6	19.2	18.8	19.0	18.7	18.7	18.8	18.4	18.1	17.8	18.92
18.3	18.7	18.8	17.3	16.5	16.1	16.2	16.2	15.9	15.8	15.8	15.8	16.0	17.25
17.8	16.8	16.7	16.7	15.9	16.8	16.5	16.5	16.8	16.8	17.0	17.0	17.0	16.87
18.1	18.4	18.2	18.0	18.2	17.9	18.2	17.8	17.4	17.4	17.5	17.4	17.4	17.66
17.3	17.1	17.0	17.4	16.9	16.6	16.8	16.6	16.2	16.5	16.4	16.3	16.4	16.87
17.5	17.3	17.2	17.3	17.7	17.6	17.4	17.4	17.7	17.3	16.6	17.2	16.8	17.00
16.5	16.5	16.5	16.6	16.4	16.01	15.9	15.7	16.0	16.2	16.1	16.1	16.1	16.21

Table 80. Hourly values of vapor

Date	Latitude	Longitude east	Values in mm, 00	01	02	03	04	05	06	07	08	09	10
1929	°	°											
Feb. 15	15.8 S	265.1	15.8	16.0	16.2	15.9	16.2	15.1	16.1	16.1	16.5	16.8	17.2
16	15.3 S	262.4	16.2	16.5	16.2	16.2	16.7	16.5	16.5	16.7	17.1	16.5	16.7
17	14.8 S	259.2	17.0	16.4	17.6	16.7	17.3	17.2	17.2	17.7	17.5	17.4	17.5
22	12.6 S	247.7	17.0	16.9	17.1	17.0	17.3	17.1	17.3	17.4	18.0	17.9	17.3
23	12.5 S	244.9	17.9	17.3	17.4	17.6	17.4	18.0	18.2	17.9	17.8	17.9	18.4
24	12.7 S	242.4	18.7	18.4	18.6	18.5	18.0	18.4	18.8	18.6	18.7	18.1	18.3
25	12.8 S	240.6	18.2	18.4	18.1	18.1	18.4	18.4	18.6	19.1	19.1	19.1	19.3
26	13.0 S	238.7	19.2	19.4	18.6	18.4	18.4	18.4	18.2	18.2	18.8	19.2	19.5
27	13.5 S	235.9	18.8	18.8	19.5	18.9	19.4	18.5	19.0	19.2	19.4	19.2	19.2
28	14.9 S	233.8	19.5	19.3	19.4	19.2	19.6	19.3	18.8	19.4	19.1	19.3	19.6
Mar. 1	16.5 S	231.9	19.3	19.4	19.4	18.2	19.0	18.9	18.9	19.3	19.4	19.2	19.8
2	17.0 S	230.2	19.4	19.1	18.0	19.1	19.2	19.6	19.3	18.9	19.3	20.2	19.5
3	17.1 S	228.3	19.6	19.6	19.8	19.0	19.3	19.0	19.3	18.9	19.2	18.9	19.5
5	17.1 S	224.6	20.5	19.7	19.7	19.9	19.8	19.6	19.7	20.5	20.4	20.6	20.4
6	17.2 S	223.4	20.2	20.4	21.1	20.8	20.9	20.8	20.6	20.4	20.5	20.8	20.5
7	17.4 S	221.1	20.3	20.1	19.2	19.5	20.2	20.6	20.3	20.3	19.6	19.6	20.2
8	17.8 S	219.2	20.1	19.8	20.0	19.7	19.4	19.4	19.5	19.5	19.3	19.6	20.1
9	17.6 S	218.0	20.8	20.8	20.8	20.9	21.1	20.6	20.3	20.8	20.4	20.9	20.3
10	18.0 S	215.9	21.3	21.5	20.9	20.9	21.7	21.5	21.3	20.6	21.8	21.0	22.1
11	18.1 S	214.4	19.7	20.0	20.2	21.1	21.5	20.5	20.0	19.7	19.9	19.8	20.4
12	17.9 S	212.0	20.6	21.3	21.5	21.4	21.3	20.6	21.0	21.2	21.0	21.1	20.8
21	16.8 S	209.2	21.7	21.9	22.4	21.6	21.5	21.5	21.3	21.2	21.9	22.4	22.6
22	17.6 S	208.2	22.2	22.3	21.8	22.2	22.3	22.1	20.9	21.3	21.2	21.1	21.2
23	17.2 S	207.3	20.4	20.9	21.1	20.7	19.8	20.0	20.0	20.3	20.4	20.2	20.6
24	16.9 S	206.3	20.8	20.9	21.3	21.1	20.8	20.7	21.0	21.2	21.1	21.0	21.2
25	16.5 S	204.0	22.8	23.0	22.4	22.4	23.0	22.9	22.8	23.2	22.8	23.2	23.4
27	15.7 S	199.4	24.2	20.6	22.2	23.3	23.7	22.9	23.6	22.9	23.8	24.0	24.0
28	15.5 S	198.0	23.1	21.6	21.5	22.2	21.5	22.4	22.8	22.6	22.5	22.4	22.5
29	15.3 S	196.7	22.4	22.1	22.1	22.3	22.1	22.1	22.3	22.4	23.1	22.8	23.2
30	14.7 S	194.4	22.3	22.3	22.8	22.3	22.4	22.4	22.3	22.5	22.8	22.4	23.2
31	14.7 S	192.1	22.6	22.5	22.4	22.6	22.4	22.3	22.5	22.5	22.5	22.0	22.0
Apr. 22	12.7 S	288.4	23.7	23.5	23.1	23.5	23.1	23.2	23.4	23.8	23.6	23.0	23.6
23	11.3 S	188.4	22.0	22.6	22.9	22.8	22.8	22.3	22.5	22.4	22.5	22.7	23.0
24	8.7 S	189.0	23.9	23.8	23.9	24.2	24.0	22.8	24.1	23.9	24.1	23.9	24.2
25	7.6 S	188.2	23.3	22.7	22.8	22.7	24.1	22.9	22.9	22.5	22.3	21.9	22.6
26	6.7 S	187.6	22.6	20.7	21.0	21.6	21.4	21.7	22.3	22.4	22.6	22.9	22.8
27	5.1 S	187.6	21.1	21.1	21.1	20.8	21.0	20.8	21.8	21.8	22.3	23.0	23.2
28	3.8 S	187.4	21.0	21.0	21.1	21.0	21.1	21.1	20.9	20.9	21.8	21.9	21.4
29	1.8 S	186.6	21.8	22.1	22.6	22.5	21.8	21.9	21.9	22.0	22.6	22.6	22.8
30	0.4 N	185.9	23.3	23.1	22.1	21.4	21.8	21.6	22.0	22.0	22.3	22.5	22.1
May 1	2.5 N	184.9	22.8	22.8	22.8	22.8	23.1	23.0	22.9	22.5	23.0	23.0	23.2
2	4.4 N	183.6	23.4	23.1	22.9	22.4	23.0	22.4	22.4	22.5	23.2	23.0	23.0
3	6.5 N	182.3	22.7	23.2	23.1	23.1	22.9	22.6	22.6	22.5	22.5	22.1	22.3
4	8.2 N	181.1	23.0	21.8	22.7	22.0	22.2	21.4	21.3	21.5	21.5	22.5	22.3
5	10.8 N	180.5	21.6	22.0	21.3	21.2	21.3	21.0	21.0	21.1	20.8	20.9	21.0
7	13.5 N	177.4	20.6	19.9	19.8	19.7	19.7	20.1	19.7	20.0	20.0	19.8	20.6
8	15.4 N	174.7	20.5	20.3	20.1	20.3	20.1	20.0	19.8	19.9	20.1	19.8	20.4
9	16.5 N	171.9	20.3	20.3	19.8	19.6	19.9	19.8	19.9	19.7	19.9	20.2	20.4
10	18.5 N	169.0	20.3	20.2	20.0	20.4	20.4	19.8	19.6	19.5	19.1	19.1	19.4
12	20.3 N	163.7	19.6	18.7	19.7	19.7	18.8	18.7	19.9	18.8	19.0	18.9	18.6
13	20.2 N	161.2	19.6	18.9	18.6	18.9	18.6	18.6	18.5	18.6	18.9	19.0	19.7
14	19.5 N	158.5	19.9	20.1	19.8	20.0	19.9	19.9	19.9	20.3	20.2	20.6	20.4
15	18.7 N	156.1	21.6	21.2	21.6	21.6	21.6	21.6	21.6	21.6	21.3	21.2	21.8
16	17.5 N	153.4	21.2	21.2	21.2	21.2	21.3	21.3	21.1	21.4	21.3	21.8	21.9
17	16.1 N	150.9	22.0	22.2	22.0	21.6	21.8	21.8	21.6	22.2	22.5	21.6	21.4
18	14.9 N	148.3	21.9	22.0	22.0	21.2	21.1	21.2	21.1	21.0	21.1	21.3	21.2
19	14.0 N	146.0	22.2	21.6	21.5	21.5	21.3	21.1	21.3	21.6	21.9	22.4	22.4
26	16.1 N	144.2	22.2	22.5	22.7	22.3	21.8	21.5	21.8	21.5	22.1	22.0	21.4
27	18.6 N	144.0	22.1	22.2	21.9	22.0	22.0	22.2	21.7	21.6	21.9	21.7	21.7
28	21.5 N	144.2	21.2	20.8	20.9	20.0	20.7	20.8	21.3	21.4	21.1	21.0	22.3
29	23.4 N	144.2	22.6	22.4	22.2	22.1	22.8	21.6	21.5	22.0	20.7	20.9	21.3
30	25.3 N	144.1	23.8	21.7	21.6	21.6	22.4	21.3	20.4	21.2	21.5	21.5	21.3
31	26.4 N	144.4	23.4	22.8	22.6	22.4	22.1	21.5	22.0	22.3	21.8	21.5	21.7
June 1	28.5 N	144.0	21.4	21.4	21.4	21.4	21.4	21.2	21.5	21.1	21.3	21.2	21.3
2	30.2 N	143.9	19.0	18.6	18.0	17.9	17.4	16.9	16.7	16.9	16.8	16.8	16.4
3	31.1 N	144.3	14.9	14.7	15.0	15.0	15.0	14.7	14.7	14.5	14.9	15.1	15.2
4	32.7 N	142.3	16.4	16.1	15.7	15.9	16.3	16.2	16.1	16.4	16.5	16.4	16.6
5	34.0 N	141.2	18.8	18.8	18.5	18.5	18.4	18.3	18.0	17.4	18.1	18.1	17.9
6	34.9 N	140.2	17.7	17.7	17.1	16.9	16.9	16.8	16.8	17.0	17.0	17.1	17.5
7	34.9 N	139.9	14.8	14.2	13.1	13.1	12.5	12.7	12.5	12.3	12.4	13.1	11.9
25	34.7 N	141.0	16.3	17.0	16.9	16.6	16.1	15.7	17.1	16.9	16.7	16.4	16.7

pressure, Carnegie, 1928-29--Continued

local mean hour													Mean
11	12	13	14	15	16	17	18	19	20	21	22	23	
													°C
16.0	16.1	16.0	14.7	16.2	16.5	16.5	16.4	16.2	16.4	16.4	16.2	16.5	16.17
16.2	17.0	16.7	16.9	15.9	16.2	17.2	16.2	16.4	16.6	16.6	17.0	17.1	16.58
17.4	17.3	16.9	17.1	17.2	17.2	17.1	17.2	17.0	17.2	17.4	16.9	16.6	17.17
18.0	17.8	18.0	18.0	17.9	17.2	17.6	17.8	17.9	17.7	17.9	17.8	17.3	17.55
18.4	18.5	17.8	18.0	18.4	17.8	18.2	18.2	18.4	18.2	18.5	18.0	18.4	18.02
18.4	18.8	18.8	19.0	19.0	19.0	18.0	17.9	17.6	17.8	17.7	18.2	18.0	18.39
19.0	18.7	19.1	19.5	19.2	19.1	19.4	19.3	18.9	19.1	19.3	18.3	18.5	18.84
19.5	19.5	19.2	19.7	18.4	19.4	19.3	19.1	19.2	19.6	19.4	19.4	19.3	19.05
18.8	18.5	18.5	18.8	19.3	19.4	19.3	18.8	19.1	19.0	19.4	19.2	19.1	19.05
19.4	19.4	19.4	18.8	19.1	19.0	18.8	19.2	18.9	18.8	18.8	19.1	19.3	19.19
19.7	19.7	20.1	20.1	19.5	19.4	19.0	19.3	18.7	19.4	18.9	19.1	19.1	19.28
20.3	19.7	19.2	20.4	20.3	19.6	19.5	19.4	19.8	19.6	19.9	20.0	19.7	19.54
19.8	19.8	19.7	20.4	20.2	19.2	19.3	20.3	19.4	19.3	20.2	20.2	20.3	19.59
20.2	20.3	20.5	20.6	20.9	19.6	20.4	20.6	20.9	20.9	19.9	20.5	19.5	20.23
20.4	20.7	20.6	21.0	20.4	19.6	19.6	19.8	19.1	19.1	20.6	20.6	19.8	20.35
20.1	20.1	20.0	20.1	20.3	19.6	20.0	20.2	20.2	19.9	19.4	19.8	20.0	19.98
19.7	20.2	20.4	19.9	20.2	20.5	21.0	20.1	20.2	20.4	20.4	20.2	20.8	20.02
20.1	20.1	20.1	20.6	20.5	20.6	20.9	20.8	20.5	20.9	21.1	20.7	21.1	20.65
21.7	21.5	18.9	20.3	21.1	20.3	19.6	19.6	20.0	19.6	19.1	19.6	19.3	20.63
20.7	19.7	20.8	21.2	20.7	20.0	19.6	19.6	20.0	19.7	19.6	19.6	20.1	20.17
21.9	21.1	20.7	21.1	20.8	21.0	20.9	19.8	21.0	21.2	20.8	20.7	20.4	20.97
22.3	21.8	21.8	21.6	21.1	20.7	21.3	22.0	20.9	20.4	21.0	21.2	22.2	21.60
20.5	20.9	21.4	21.9	21.8	21.4	20.6	20.9	20.3	20.7	21.0	20.6	20.7	21.30
20.8	20.7	20.9	21.4	21.5	21.6	21.2	20.6	20.4	20.7	20.5	20.8	20.6	20.67
22.0	21.7	21.7	21.6	22.2	22.0	22.3	22.0	22.2	22.6	22.7	22.5	22.9	21.65
23.2	23.3	23.3	23.5	22.2	22.0	22.7	22.9	22.9	23.6	22.8	23.8	23.7	22.99
24.0	24.0	24.3	23.4	24.0	21.7	22.5	23.7	22.7	23.1	23.2	23.5	22.8	23.25
22.2	22.0	21.8	22.0	22.8	20.9	21.8	21.9	22.2	22.2	22.8	22.6	22.3	22.19
23.0	22.7	22.5	22.8	22.3	23.0	22.5	22.2	22.0	22.5	22.8	22.6	22.5	22.51
22.8	22.6	21.8	22.7	22.6	22.4	22.5	23.0	22.9	22.8	22.7	22.4	22.3	22.55
23.8	23.3	23.0	23.1	22.4	23.5	23.4	22.2	22.3	22.6	22.5	22.9	22.6	22.66
24.0	23.7	23.9	23.1	21.9	22.0	22.3	21.9	21.2	22.0	20.6	21.0	21.5	22.78
23.4	23.7	23.4	23.5	23.9	23.9	23.9	23.7	23.9	23.8	24.0	24.1	23.3	23.21
24.0	23.0	24.2	23.3	22.7	23.7	23.3	23.4	23.4	23.5	23.4	23.6	23.0	23.64
23.4	23.3	23.2	23.0	23.4	23.2	22.7	22.2	22.6	23.0	22.8	22.8	23.0	22.89
22.4	21.7	23.2	22.6	22.3	22.8	23.3	22.0	21.4	22.8	22.7	21.5	21.1	22.16
22.3	21.8	22.0	22.2	21.4	21.1	22.4	21.5	22.1	22.3	22.3	22.4	21.0	21.78
21.9	22.0	22.3	22.3	22.3	22.4	22.5	22.4	22.4	22.3	22.1	22.1	22.1	21.76
22.7	22.7	22.9	22.8	22.6	22.6	22.4	22.7	22.6	22.8	22.8	22.8	23.3	22.51
22.5	22.0	21.5	21.3	21.8	21.8	21.8	21.8	21.9	22.2	22.4	22.9	22.8	22.12
22.7	23.4	22.9	23.0	23.4	23.2	23.5	23.6	23.2	23.3	23.3	23.0	23.5	23.08
23.5	23.0	22.9	23.2	23.0	22.8	23.2	22.4	22.3	22.5	22.4	22.5	22.6	22.82
22.2	22.0	22.1	22.8	22.2	22.8	22.6	21.3	21.5	21.8	21.3	22.4	22.9	22.40
22.1	22.5	22.5	22.4	21.5	22.0	22.0	21.7	21.6	22.2	22.4	22.2	21.8	22.05
20.7	20.7	21.1	21.2	20.6	20.6	21.1	20.3	21.5	21.2	21.2	20.3	20.6	21.01
20.5	21.1	21.1	20.8	21.0	20.5	19.9	20.3	20.3	20.9	20.3	19.5	20.9	20.25
20.4	19.6	20.1	20.3	20.2	20.3	20.2	20.1	20.1	20.2	20.1	20.7	20.8	20.18
20.6	20.7	20.5	21.0	20.0	20.2	21.3	20.6	20.6	20.5	20.6	20.2	20.4	20.29
19.0	19.3	18.7	19.2	19.1	19.4	18.7	18.7	18.7	18.7	18.7	19.1	19.6	19.36
18.0	19.2	19.2	18.9	18.3	18.5	18.4	19.2	18.9	18.8	19.3	19.5	19.7	19.01
18.9	19.6	19.7	18.8	19.6	19.9	19.8	20.0	19.9	19.9	19.9	19.8	19.9	19.32
20.6	20.1	19.8	19.8	20.9	19.6	19.6	19.8	19.7	20.6	20.9	20.8	21.0	20.18
21.2	21.1	21.2	21.2	21.2	21.2	21.6	21.2	21.6	21.4	21.2	21.2	21.7	21.40
22.3	21.8	21.4	22.3	21.6	21.9	22.1	22.4	21.6	22.2	22.3	22.5	22.6	21.75
21.2	20.9	20.8	21.3	21.2	21.3	21.6	21.3	21.8	22.6	22.6	22.3	22.6	21.76
20.9	21.8	22.0	22.4	22.4	22.4	22.2	22.4	22.3	22.5	22.5	21.8	22.2	21.79
21.9	22.3	22.3	22.2	21.6	21.5	22.0	22.6	22.8	22.6	22.6	22.6	22.6	22.02
21.9	21.9	21.9	22.0	22.1	22.1	22.4	21.1	21.6	21.4	22.0	21.2	22.0	21.89
21.6	22.0	22.0	22.1	22.0	21.9	22.0	22.2	22.4	22.3	22.3	20.8	21.9	21.94
21.9	22.1	22.3	22.3	21.6	21.9	22.2	22.3	22.5	22.4	22.6	22.1	22.3	21.67
22.0	21.5	22.0	22.0	22.1	22.4	22.6	23.0	23.1	23.1	23.4	23.5	23.7	22.27
22.0	21.6	22.1	22.1	22.3	22.0	22.1	22.1	22.3	22.3	22.2	22.5	23.7	21.98
22.4	22.4	22.8	22.8	22.3	22.3	22.5	22.4	22.2	22.3	21.9	22.0	21.5	22.25
21.1	20.8	21.0	21.0	20.4	20.1	19.9	19.9	19.9	19.8	19.5	19.8	19.6	20.72
16.3	16.1	15.6	15.0	14.9	14.8	14.9	15.0	15.0	14.5	14.7	14.3	14.8	16.14
15.0	15.3	15.5	15.9	16.0	16.1	15.9	16.1	16.2	16.3	16.3	16.5	16.7	15.48
16.6	17.2	17.0	17.2	17.3	17.5	17.7	17.8	17.8	17.9	17.9	18.4	18.7	16.98
18.1	17.8	17.7	17.4	18.2	18.1	17.4	17.4	17.6	16.7	16.9	16.9	17.0	17.83
17.5	17.2	16.9	16.5	15.5	15.2	15.0	14.9	15.0	15.1	15.1	14.8	14.9	16.34
11.7	11.3	11.4	11.2	11.4	11.6	11.1	10.9	10.9	11.6	11.6	11.5	11.5	12.10
17.0	16.9	17.3	16.7	16.7	16.7	16.7	16.5	16.6	17.3	17.3	18.0	17.7	16.82

Table 80. Hourly values of vapor

Date	Latitude	Longitude east	Values in mm, 00	01	02	03	04	05	06	07	08	09	10
1929	°	°											
June 26	36.0 N	142.1	17.7	16.6	16.6	16.5	16.4	16.4	16.1	16.2	16.1	16.3	16.7
27	36.7 N	143.6	15.6	15.7	15.7	15.4	15.5	15.6	15.8	16.0	16.1	16.1	16.2
28	36.8 N	145.4	16.7	16.7	16.7	16.7	16.5	16.5	16.6	16.4	16.1	16.1	15.3
29	37.8 N	145.5	13.8	13.6	13.3	13.3	13.4	13.2	12.7	12.5	12.5	12.6	12.6
30	38.1 N	147.1	12.2	12.8	12.5	13.1	13.1	12.5	12.8	12.7	12.6	12.3	12.7
July 1	38.7 N	147.7	12.6	12.6	12.6	12.4	12.5	12.5	12.6	12.4	12.3	12.3	12.4
2	39.8 N	149.5	10.2	10.2	10.2	10.3	10.4	10.4	10.5	10.8	10.7	10.5	10.6
3	40.4 N	151.1	10.9	10.4	10.0	10.2	10.3	10.0	9.8	10.1	9.9	9.9	9.9
4	41.3 N	153.1	10.1	10.1	9.7	9.0	9.1	9.1	9.2	9.4	9.3	9.2	9.1
5	42.6 N	155.6	9.5	9.4	9.4	9.4	9.4	9.4	9.5	9.4	9.4	9.4	9.5
6	43.8 N	158.3	9.5	9.1	9.2	9.2	9.1	8.9	8.9	8.9	8.9	9.0	9.1
7	45.4 N	159.6	8.9	8.8	8.8	8.5	8.4	8.5	8.4	8.3	8.2	8.2	8.1
8	46.9 N	163.0	8.7	8.5	8.7	8.4	8.4	8.3	8.2	7.9	7.9	7.9	8.0
9	47.0 N	166.6	7.4	7.3	7.7	7.4	7.3	7.3	7.4	7.4	7.5	7.5	7.4
10	46.7 N	169.5	7.8	7.9	7.7	7.5	7.5	7.5	7.4	7.4	7.4	7.3	7.3
11	46.0 N	171.7	7.6	7.6	7.6	7.3	7.3	7.2	7.2	7.3	7.2	7.3	7.3
12	45.3 N	173.1	8.3	8.2	8.3	8.3	8.3	8.4	8.3	8.4	8.4	8.5	8.5
13	46.2 N	174.1	8.6	8.7	8.5	8.5	8.5	8.6	9.0	8.9	9.0	8.8	8.9
14	48.1 N	178.1	9.0	9.2	9.1	9.0	9.0	8.9	9.0	8.9	8.9	8.9	8.9
14	49.2 N	183.3	8.9	8.9	8.9	9.1	8.9	8.8	8.8	9.0	8.7	8.7	8.7
15	50.5 N	187.2	8.6	8.9	8.6	8.4	8.3	8.2	8.3	8.5	8.3	8.3	8.5
16	51.4 N	192.7	8.6	8.7	8.8	8.8	8.5	8.7	8.8	8.9	8.9	8.9	8.8
17	52.4 N	198.2	8.8	8.7	8.7	8.5	8.5	8.5	8.5	8.4	8.4	8.7	8.8
18	52.6 N	204.4	8.6	9.0	8.9	8.9	8.7	8.9	9.0	8.8	8.7	8.8	8.9
19	52.0 N	209.6	9.3	9.3	9.4	9.6	9.6	9.6	9.5	9.6	9.5	9.4	9.5
20	50.2 N	213.9	9.5	9.5	9.5	9.7	9.7	9.6	9.6	9.5	9.6	9.6	9.8
21	48.0 N	217.3	9.6	9.7	9.9	9.7	9.5	9.3	9.3	9.1	9.0	9.2	8.6
22	46.0 N	220.3	8.8	9.2	8.8	9.1	8.7	8.9	8.9	9.0	9.2	9.1	9.1
23	44.3 N	222.4	9.0	9.0	8.7	9.0	9.3	9.5	9.1	8.9	9.1	8.7	9.0
24	42.6 N	224.8	9.5	9.2	9.8	9.3	9.6	9.4	9.3	9.7	9.4	10.1	10.0
25	40.7 N	227.7	10.5	10.4	10.5	10.6	10.4	10.7	10.7	10.5	11.1	11.4	11.7
26	39.6 N	230.5	13.0	12.2	12.4	12.1	11.9	12.1	11.4	10.9	10.8	10.6	10.8
27	38.8 N	234.3	10.9	10.9	10.7	11.0	11.7	11.6	11.8	11.9	12.0	12.1	12.0
28	38.2 N	237.2	10.5	10.4	10.2	10.6	9.9	10.3	10.2	10.1	10.2	9.7	10.2
Sep. 4	37.0 N	236.3	10.6	10.7	10.9	11.1	11.2	11.1	10.9	11.0	10.5	10.5	10.4
5	35.5 N	235.0	11.5	11.5	11.1	11.0	11.3	11.6	11.6	11.5	11.4	11.6	11.4
6	33.8 N	233.7	13.1	13.0	13.1	12.9	13.0	13.0	12.7	13.1	13.1	13.4	13.5
7	32.4 N	232.1	13.0	12.9	12.9	12.7	12.8	12.7	12.3	12.9	12.2	12.1	12.0
8	31.6 N	231.2	13.1	12.5	11.7	11.5	12.7	12.1	13.2	13.0	13.1	12.2	11.7
9	30.4 N	229.0	12.6	12.3	12.1	12.9	12.9	13.1	12.8	13.1	12.6	13.2	13.5
10	29.3 N	227.4	12.9	12.6	13.1	12.6	12.8	12.3	12.6	12.6	12.7	13.2	12.9
11	28.2 N	225.7	12.8	12.4	12.8	12.8	13.6	13.8	14.1	14.0	13.4	13.9	13.6
12	27.7 N	224.6	13.6	13.5	13.7	13.6	14.0	13.8	13.6	13.7	14.0	14.1	13.6
13	27.0 N	222.3	13.2	13.4	13.5	13.8	13.5	14.2	14.4	14.3	14.5	14.6	14.5
14	26.7 N	220.9	17.2	17.0	16.4	14.3	15.2	15.3	15.6	15.9	16.4	16.8	16.2
15	26.5 N	219.4	16.2	16.2	16.3	16.5	16.1	16.2	16.0	16.3	16.2	17.2	16.9
16	26.2 N	217.9	17.0	17.2	17.2	17.2	17.2	17.2	17.2	16.8	16.4	16.6	16.7
17	25.1 N	216.4	16.1	16.9	16.5	16.8	16.6	16.6	16.9	16.6	16.6	16.7	16.5
18	24.0 N	214.4	17.4	18.2	16.8	17.8	16.8	16.8	16.2	16.5	16.2	16.3	15.4
19	23.4 N	211.3	16.8	16.8	16.6	16.8	16.8	16.8	16.4	16.9	16.5	16.8	16.4
20	22.9 N	208.6	18.1	17.3	17.0	16.2	18.0	17.7	17.9	17.9	18.3	18.2	16.5
21	22.3 N	206.4	19.5	19.6	19.3	18.6	18.6	19.5	18.9	18.3	19.0	19.2	20.1
22	21.7 N	204.3	19.9	20.1	19.8	20.2	19.7	10.7	19.7	19.2	19.6	19.4	19.7
23	21.3 N	202.1	20.0	19.5	19.9	19.7	19.7	19.8	19.6	19.5	20.2	20.1	19.9
Oct. 3	23.5 N	200.4	19.6	19.5	19.6	19.4	19.4	19.3	19.2	18.9	19.0	18.8	19.0
4	26.4 N	199.5	17.9	17.8	17.6	17.9	17.9	17.8	17.8	17.8	17.8	18.2	18.8
5	29.1 N	198.8	16.5	16.5	16.9	17.8	17.8	18.0	16.9	16.9	17.6	17.7	18.1
6	31.7 N	199.0	17.6	17.8	17.7	17.5	17.2	17.2	17.3	17.6	17.8	17.9	18.0
7	32.8 N	199.3	17.2	17.3	17.8	18.1	17.5	17.1	17.1	16.9	16.9	16.8	17.4
10	33.6 N	205.5	12.7	12.7	12.6	12.5	12.4	12.5	12.6	12.5	12.5	12.5	12.5
11	33.7 N	208.3	16.6	17.3	17.4	17.9	17.7	17.8	18.3	18.3	18.4	17.7	18.4
12	33.3 N	212.3	18.3	17.9	17.8	17.7	18.5	18.2	18.1	17.8	16.9	17.1	17.0
13	33.4 N	214.6	15.4	14.5	14.7	14.7	14.6	13.9	14.2	13.9	14.1	12.8	13.4
14	33.6 N	216.9	12.7	12.9	13.4	13.5	14.0	14.5	15.0	15.1	15.6	15.6	15.9
15	31.8 N	219.3	16.2	16.3	16.1	16.3	16.1	15.9	16.1	16.2	16.2	16.4	16.7
16	29.1 N	220.8	14.5	14.1	14.5	14.1	14.1	15.3	15.0	15.3	15.4	15.2	15.6
17	27.4 N	221.9	16.4	16.4	16.4	16.2	16.2	16.0	15.9	15.8	15.6	15.5	15.5
19	25.0 N	222.2	15.5	15.4	15.8	15.8	16.0	15.9	16.1	14.8	14.9	15.7	15.9
20	23.2 N	221.7	17.2	17.4	17.0	17.3	17.0	16.9	17.1	16.9	17.3	17.2	17.5
21	21.2 N	221.5	16.2	16.2	16.0	16.4	15.9	16.4	16.1	15.7	16.0	16.4	15.8
22	18.3 N	222.0	17.5	17.5	17.1	17.5	17.3	17.5	17.7	17.2	17.0	16.8	16.8
23	16.2 N	223.0	17.0	16.9	17.1	17.9	17.7	17.0	17.0	16.8	16.9	16.7	16.8

pressure, Carnegie, 1928-29--Continued

local mean hour													Mean
11	12	13	14	15	16	17	18	19	20	21	22	23	
													°C
17.0	17.0	17.2	17.1	16.6	17.1	17.2	16.3	16.2	15.7	15.9	15.7	15.9	16.52
16.5	16.7	16.5	16.3	16.9	17.0	17.2	17.1	17.1	17.2	16.9	16.8	16.8	16.36
15.2	15.1	14.9	15.1	16.3	16.7	16.7	17.0	15.2	14.9	14.3	14.3	13.3	15.80
12.5	12.5	12.2	12.1	12.0	12.0	12.2	12.2	12.0	12.0	12.0	12.3	12.7	12.59
13.8	13.8	14.0	14.2	14.0	13.5	13.4	12.6	12.6	12.6	12.6	12.7	13.3	13.01
12.4	12.3	12.0	11.8	11.7	11.3	11.3	11.0	10.8	10.8	10.9	10.7	10.5	11.86
10.5	10.5	10.7	10.7	10.7	11.2	11.1	10.9	11.0	10.9	10.9	10.6	10.9	10.64
10.0	10.3	9.7	9.7	9.8	9.4	9.7	9.6	9.3	9.6	9.7	9.9	9.9	9.92
8.9	9.1	9.1	9.1	9.1	9.1	9.3	9.3	9.5	9.6	9.6	9.6	9.8	9.35
9.3	9.4	9.4	9.4	9.4	9.4	9.2	9.1	9.2	9.2	9.4	9.5	9.4	9.38
9.1	9.1	9.0	9.2	9.1	9.3	9.3	9.2	8.9	8.9	8.9	8.9	8.8	9.06
8.3	8.5	8.4	8.5	8.5	8.5	8.3	8.3	8.3	8.4	8.6	8.5	8.6	8.45
7.8	7.8	7.5	7.5	7.0	7.2	7.0	6.8	7.0	7.0	7.0	7.2	7.2	7.70
7.4	7.5	7.4	7.6	7.3	7.4	7.3	7.4	7.4	7.4	7.5	7.5	7.8	7.44
7.3	7.4	7.5	7.5	7.1	7.1	7.3	7.2	7.3	7.4	7.5	7.4	7.4	7.42
7.2	7.1	7.1	7.2	7.2	7.3	7.2	7.2	7.4	7.6	7.7	7.9	8.2	7.38
8.6	8.5	8.6	8.5	8.4	8.3	8.3	8.4	8.3	8.3	8.3	8.3	8.5	8.38
9.1	9.5	9.3	9.6	9.3	9.1	9.0	8.9	8.9	9.0	9.1	9.2	9.2	8.97
9.0	8.9	8.9	8.9	8.8	9.0	9.0	8.9	8.9	8.8	8.8	8.9	9.0	8.94
8.8	8.7	8.6	8.4	8.6	8.8	8.7	8.5	8.5	8.4	8.5	8.5	8.4	8.70
8.6	8.7	8.7	8.6	8.6	8.6	8.5	8.3	8.4	8.5	8.6	8.6	8.5	8.50
8.9	8.8	8.9	8.9	8.8	8.7	8.7	8.8	8.8	8.9	8.9	8.9	8.9	8.80
8.8	8.8	8.9	9.0	8.9	8.9	8.8	8.9	8.9	8.9	8.6	8.6	8.6	8.71
8.9	8.9	8.9	9.0	8.9	8.9	8.9	8.9	9.1	9.1	9.1	9.1	9.2	8.92
9.5	9.6	9.5	9.5	9.5	9.5	9.5	9.6	9.6	9.6	9.6	9.6	9.6	9.52
9.7	9.7	9.8	9.8	9.4	9.5	9.5	9.5	9.5	9.5	9.4	9.4	9.5	9.53
8.9	8.8	8.9	8.9	8.8	8.7	8.9	9.1	8.7	9.1	9.0	8.7	8.7	9.09
9.3	8.9	8.9	9.2	8.8	9.1	8.9	8.9	9.0	8.9	9.2	9.2	9.1	9.01
9.0	8.9	8.4	9.0	9.1	9.2	9.2	9.2	9.2	9.4	9.4	9.5	9.5	9.10
10.0	9.9	10.1	10.4	10.0	10.4	10.1	10.3	10.8	10.1	10.8	10.6	10.6	9.98
11.7	11.8	12.3	12.6	12.7	12.8	12.9	13.0	13.0	13.1	13.2	13.2	13.2	11.83
11.5	11.3	11.2	11.4	11.5	11.6	11.5	10.6	11.3	10.6	10.8	11.0	10.9	11.39
12.1	12.0	11.9	11.9	12.0	12.2	12.0	11.9	11.8	11.2	10.8	10.6	10.6	11.57
10.3	10.5	10.4	10.7	11.2	11.4	11.4	11.4	11.4	12.4	12.4	12.4	12.3	10.85
10.4	10.4	10.5	10.8	10.8	11.0	10.9	11.0	11.0	11.0	11.0	11.0	11.0	10.82
11.5	11.5	12.0	11.5	11.2	11.8	11.4	11.5	11.7	11.8	12.1	12.6	12.7	11.62
12.5	13.2	12.8	13.3	13.1	13.3	13.5	13.1	12.4	13.1	12.2	12.7	12.3	12.98
12.2	13.1	13.0	13.0	12.7	12.6	12.5	13.3	13.1	12.8	12.8	12.7	12.8	12.71
12.3	11.9	11.9	12.4	12.4	13.3	13.6	13.8	13.6	12.9	13.7	12.8	12.6	12.67
12.5	13.1	13.0	13.1	13.5	13.5	13.5	13.3	12.9	13.1	12.8	12.8	12.6	12.95
13.2	13.0	13.0	13.1	13.3	13.4	13.0	13.6	13.3	13.2	13.4	13.3	13.3	13.02
13.2	12.7	13.3	13.0	12.6	12.9	13.2	12.5	13.4	13.9	14.2	14.5	13.4	13.33
13.5	13.8	13.0	14.1	14.0	13.9	13.9	13.3	13.5	13.3	13.4	13.4	13.2	13.65
14.1	14.3	14.9	14.6	14.5	14.4	13.6	14.2	14.3	14.5	14.4	14.4	14.7	14.20
15.8	15.6	16.1	16.5	16.5	16.7	16.4	15.9	16.0	16.2	15.8	16.1	16.4	16.10
17.1	17.2	17.2	17.2	17.1	17.1	17.2	17.1	17.2	17.2	17.2	17.3	17.2	16.81
16.6	16.7	16.7	16.8	16.5	16.2	15.5	15.4	15.9	15.9	16.3	16.8	16.7	16.61
17.3	17.1	17.3	17.2	16.9	16.7	16.8	16.4	16.8	16.8	16.9	16.9	17.0	16.79
15.5	16.6	16.2	16.5	16.5	16.7	16.7	16.7	16.7	16.9	16.7	17.2	16.9	16.68
16.2	15.7	16.3	15.9	15.9	16.4	16.6	16.8	16.6	16.9	16.9	17.7	18.1	16.65
17.2	17.5	17.8	18.4	18.1	18.9	18.1	18.4	18.1	17.7	17.9	18.8	19.3	17.89
19.9	19.4	19.0	19.5	19.6	19.5	19.8	19.7	19.7	19.8	19.8	20.9	19.6	19.45
20.2	20.1	19.4	20.1	20.2	20.1	20.1	19.9	19.5	19.9	20.2	19.0	19.6	19.80
20.3	18.9	20.3	21.1	21.7	21.0	21.1	19.8	18.6	17.6	18.7	19.1	19.0	19.80
19.4	20.2	19.4	19.1	19.1	19.4	19.0	19.0	19.1	18.6	19.0	18.1	17.8	19.12
18.1	18.5	18.7	18.4	18.1	18.4	17.9	17.6	17.5	17.5	16.5	16.7	16.5	17.82
17.9	18.1	18.1	17.8	18.7	18.1	18.3	17.3	18.3	16.9	18.0	17.8	17.8	17.66
17.8	18.1	18.2	18.3	18.0	18.1	18.0	18.1	18.0	17.9	17.8	17.8	17.7	17.81
17.9	18.0	17.9	18.2	18.2	18.2	18.3	17.8	17.4	17.6	17.5	17.4	17.9	17.60
13.1	13.0	13.1	13.8	13.9	14.0	13.4	13.7	14.5	14.9	15.0	16.2	16.3	13.45
17.1	17.7	19.0	18.4	18.8	18.5	18.3	16.6	17.7	18.0	17.5	17.9	17.9	17.88
17.1	16.5	16.6	16.1	16.0	16.2	16.8	16.5	16.7	18.4	16.3	15.8	15.6	17.08
13.9	14.0	13.1	12.5	12.4	12.5	11.8	12.0	11.9	12.0	12.2	12.5	12.5	13.31
16.0	16.1	16.3	16.3	16.2	15.3	15.1	14.9	14.9	14.9	15.8	15.8	16.2	15.08
15.3	15.3	15.2	15.0	15.1	14.9	14.0	13.7	13.8	13.8	14.1	14.2	14.0	15.29
15.4	16.0	16.2	16.6	16.8	17.6	17.7	17.1	16.9	16.9	17.5	17.5	17.0	15.93
15.5	15.8	16.3	15.9	15.7	15.7	15.4	14.6	14.6	14.7	14.7	14.7	14.7	15.59
15.5	16.3	15.9	16.4	16.6	15.7	16.2	16.3	16.4	16.7	16.9	16.9	17.0	16.02
16.8	17.0	16.2	16.4	16.6	17.1	16.7	16.5	16.3	16.3	16.3	16.3	16.6	16.83
15.9	16.2	16.1	16.3	16.8	16.4	16.9	16.9	16.4	17.0	16.8	16.9	16.8	16.35
17.1	16.9	17.1	17.1	17.2	17.0	17.0	17.2	17.2	17.1	17.0	16.8	17.0	17.15
16.8	16.9	17.1	17.1	16.8	17.8	17.6	17.8	18.1	18.2	18.5	18.7	19.2	17.43

Table 80. Hourly values of vapor

Date	Latitude	Longitude east	Values in mm,										
			00	01	02	03	04	05	06	07	08	09	10
1929	°	°											
Oct. 24	13.6 N	223.5	18.8	19.0	19.1	19.6	19.9	20.1	20.3	20.4	20.3	21.0	21.6
25	12.7 N	222.5	20.8	20.7	18.9	20.1	19.5	19.4	19.4	20.0	20.0	19.9	19.2
26	11.3 N	221.3	18.8	18.9	18.8	18.9	19.4	18.8	18.6	18.9	19.0	19.3	19.8
27	10.1 N	220.3	20.6	19.9	20.1	19.5	20.5	20.6	20.6	20.8	20.7	20.7	20.8
28	8.6 N	219.2	21.5	21.5	21.5	20.4	20.5	20.3	20.6	21.1	21.2	21.3	21.6
29	7.7 N	218.6	21.3	21.3	20.9	21.2	21.0	21.2	20.9	20.7	21.4	21.2	21.0
30	7.1 N	217.4	21.2	21.6	21.6	21.2	21.4	21.4	21.3	21.2	22.1	22.2	22.2
31	6.7 N	216.6	20.7	20.6	20.7	20.4	20.5	20.9	20.4	20.3	20.9	21.1	21.0
Nov. 1	5.8 N	215.3	21.7	22.1	21.3	21.4	21.7	21.7	21.7	21.7	21.7	21.3	21.6
2	4.9 N	213.2	21.8	21.7	21.7	21.3	21.5	21.4	21.9	21.2	21.3	20.8	21.0
3	4.3 N	210.7	21.2	21.0	21.0	20.5	20.4	20.4	20.4	20.5	20.4	20.7	20.4
4	3.0 N	210.2	20.3	20.8	20.9	20.4	20.4	20.5	19.9	20.3	20.1	20.2	20.4
5	0.8 N	208.5	21.1	20.8	20.9	20.9	20.6	21.0	20.6	21.0	20.8	20.9	21.1
6	1.8 S	207.6	21.2	21.1	21.3	21.3	21.1	21.3	21.3	20.9	21.3	22.1	21.9
7	4.9 S	206.6	20.9	20.7	20.6	20.6	19.9	20.4	20.1	20.1	19.9	20.2	20.2
8	6.6 S	204.9	20.5	20.5	20.5	20.6	20.4	20.2	19.7	20.4	20.7	20.6	20.3
9	8.1 S	203.1	20.6	20.6	20.8	20.8	20.6	20.8	20.6	21.8	21.7	21.6	21.4
10	9.0 S	201.9	22.1	22.1	21.4	20.7	20.4	20.4	20.9	20.4	21.5	21.0	20.6
11	9.4 S	200.9	20.9	20.7	21.7	21.2	21.7	21.1	20.8	20.9	22.0	21.9	21.7
12	10.3 S	198.9	21.3	21.3	21.5	21.7	21.9	21.5	21.9	21.3	22.4	21.8	21.5
13	11.0 S	198.0	21.5	21.2	21.3	21.2	21.0	21.2	21.1	20.6	21.5	21.0	21.8
14	11.6 S	196.6	19.4	19.8	20.2	19.9	20.2	19.8	19.7	20.1	20.0	20.6	20.6

pressure, Carnegie, 1928-29--Concluded

local mean hour													Mean
11	12	13	14	15	16	17	18	19	20	21	22	23	
													°C
21.7	21.7	21.6	21.7	21.8	21.9	22.0	21.8	21.1	20.6	21.7	21.7	21.7	20.88
20.0	19.1	19.1	19.0	18.6	18.7	18.6	18.7	18.7	18.8	18.3	18.5	18.6	19.28
19.8	20.2	20.3	19.8	19.1	20.2	21.0	19.8	19.9	20.5	20.6	20.6	20.8	19.66
20.8	21.1	20.8	20.7	21.3	21.5	23.1	21.1	21.0	21.0	21.3	21.3	21.4	20.88
21.8	21.8	21.1	21.0	20.4	19.9	20.6	20.2	20.2	21.0	20.7	21.1	21.2	20.94
21.8	20.9	22.3	21.6	21.0	20.8	20.9	21.1	20.8	21.0	21.1	21.6	21.4	21.18
21.3	21.7	22.3	21.7	21.3	21.3	21.4	21.4	21.6	21.1	20.2	20.7	20.7	21.42
20.4	20.5	21.1	20.0	21.0	21.3	21.2	21.2	21.2	21.2	21.4	22.3	21.3	20.90
21.6	21.5	21.2	21.6	21.5	21.3	21.8	21.6	21.7	21.9	22.1	22.2	22.0	21.66
20.8	20.6	20.8	21.1	21.2	20.8	20.0	20.3	20.7	20.6	20.6	21.0	21.1	21.05
20.3	20.5	20.5	20.2	20.0	20.2	20.2	19.9	19.8	19.7	19.9	19.9	19.6	20.32
20.4	20.4	20.3	20.3	20.3	20.6	19.7	20.6	20.6	20.6	20.6	20.7	21.1	20.43
20.9	20.9	21.1	21.0	21.3	21.3	21.4	21.3	21.3	21.1	21.2	21.0	21.2	21.03
21.4	21.4	20.9	20.9	20.8	21.0	21.0	21.3	20.9	20.9	20.7	21.1	20.7	21.16
20.0	20.1	20.0	20.4	18.9	18.9	19.4	20.6	20.5	20.5	20.5	20.5	20.5	20.18
20.4	20.4	20.1	20.4	20.6	20.5	19.9	20.5	20.6	20.6	20.8	20.8	21.0	20.46
21.7	21.6	21.7	21.7	21.4	21.6	21.6	21.6	21.6	21.9	22.1	22.1	22.1	21.42
20.6	20.9	20.9	20.3	20.9	20.5	20.4	20.4	20.7	20.5	20.7	20.7	20.9	20.83
21.5	21.6	21.4	21.5	21.4	21.6	20.5	20.7	20.6	20.8	21.0	21.2	21.1	21.23
21.6	21.4	21.6	21.2	21.4	21.6	20.6	20.4	20.5	21.0	20.5	20.6	20.7	21.30
20.2	20.1	20.0	20.0	20.1	19.9	19.9	20.0	19.9	19.5	19.5	19.2	18.9	20.44
20.3	20.3	20.0	20.3	18.8	17.6	18.8	19.4	18.6	18.5	19.0	20.5	20.5	19.70

Table 81. Hourly values of relative

From corrected Negretti-Zambra

Date	Latitude	Longitude east	Values in per cent, 00	01	02	03	04	05	06	07	08	09	10
1928	°	°											
July 29	60.7 N	328.8	90	91	88	96	96	95	96	93	88	88	89
30	59.3 N	325.8	90	89	89	88	88	90	91	91	91	86	85
31	57.9 N	325.6	82	85	84	84	85	85	87	86	83	82	79
Aug. 1	58.3 N	324.2	92	91	92	92	93	94	96	96	98	98	96
2	58.3 N	321.3	92	95	95	91	88	83	85	85	83	81	84
3	57.9 N	314.5	84	84	85	85	85	85	85	84	83	84	81
4	54.5 N	311.0	85	90	87	85	86	87	88	83	85	87	83
5	51.6 N	310.4	83	82	77	84	84	85	82	82	83	82	82
6	48.4 N	311.8	85	81	81	80	79	81	83	80	79	83	81
7	45.9 N	312.1	86	88	88	87	87	87	86	86	87	87	85
8	43.2 N	313.0	77	77	77	76	76	75	78	78	79	83	81
9	42.2 N	312.7	80	78	78	77	76	77	74	74	76	69	72
10	39.8 N	311.1	77	79	77	75	78	78	90	90	88	96	90
11	38.6 N	311.2	87	89	86	90	87	86	84	84	85	85	85
12	37.0 N	311.6	86	85	84	83	84	84	83	82	80	83	80
13	36.8 N	313.4	85	82	87	88	85	82	84	87	89	89	85
14	35.2 N	315.6	86	85	85	86	84	84	85	88	87	86	87
15	33.6 N	317.7	86	89	85	88	88	88	88	89	89	86	84
16	31.2 N	318.8	87	87	87	86	86	86	83	86	85	85	86
17	29.8 N	319.4	83	86	84	84	84	85	84	81	79	82	81
18	27.9 N	320.5	79	79	79	78	79	78	78	77	75	80	78
19	25.7 N	321.0	78	78	78	78	77	77	80	88	83	80	81
20	24.0 N	320.4	74	71	71	72	72	70	72	81	84	69	74
21	21.8 N	320.4	82	81	79	75	76	76	76	76	76	78	73
22	19.2 N	321.5	77	78	79	80	82	82	84	83	82	81	83
23	16.6 N	322.2	82	80	82	85	85	83	84	86	83	83	80
24	15.8 N	322.1	85	85	85	83	88	87	87	83	79	78	75
25	14.9 N	321.8	81	82	83	83	84	83	85	89	92	83	81
26	13.9 N	322.0	86	87	84	85	87	85	91	85	85	82	79
27	13.4 N	322.0	86	86	85	85	83	84	86	84	84	84	81
28	11.9 N	322.2	80	82	83	81	82	82	83	83	80	80	81
29	10.8 N	322.6	88	87	87	89	87	85	86	87	85	84	83
30	9.5 N	322.8	83	84	84	83	83	82	85	84	81	80	78
31	8.2 N	323.8	89	86	84	87	90	85	84	83	83	81	83
Sep. 1	9.4 N	323.3	85	85	84	84	87	86	84	84	86	81	79
2	9.8 N	323.3	85	84	82	83	83	83	83	83	80	78	76
3	11.2 N	322.9	84	86	91	86	84	84	85	82	79	80	79
4	11.4 N	322.0	85	85	88	85	86	89	83	82	78	77	76
5	11.6 N	319.2	81	80	78	79	79	79	78	77	75	77	76
6	11.7 N	317.4	79	77	77	77	77	77	78	77	76	73	71
7	11.3 N	315.8	82	82	83	83	81	81	81	77	77	77	73
8	11.6 N	314.9	77	77	79	80	80	79	81	84	71	70	70
9	11.8 N	313.9	76	77	77	78	79	79	79	79	77	75	72
10	12.2 N	312.2	79	77	79	82	86	80	84	83	89	84	83
11	13.2 N	310.3	80	81	78	80	80	78	79	73	73	73	75
12	13.2 N	309.5	79	80	80	78	78	79	80	78	78	73	75
13	13.3 N	307.6	81	83	83	78	79	79	77	75	76	74	73
14	13.0 N	305.7	71	71	74	74	73	73	71	71	70	65	66
15	12.9 N	303.7	75	76	75	77	75	77	76	76	74	75	76
Oct. 2	14.7 N	298.6	76	77	77	77	77	76	77	75	68	68	72
3	14.8 N	296.4	78	78	79	79	77	79	79	77	77	77	79
4	15.0 N	293.9	78	76	80	78	78	76	79	78	79	76	81
5	15.3 N	291.8	77	76	77	73	76	74	79	78	75	75	76
6	15.2 N	288.8	81	81	80	81	83	82	81	81	80	81	77
7	14.5 N	286.0	81	81	80	81	83	81	82	79	79	80	79
8	13.2 N	283.6	81	83	82	82	83	81	81	81	79	81	82
9	11.4 N	281.4	80	80	82	83	81	84	84	84	83	82	81
10	10.3 N	280.7	84	83	85	90	88	89	86	85	85	83	81
26	6.7 N	280.1	85	86	82	81	81	87	87	89	90	94	93
27	5.7 N	279.9	92	95	90	93	94	95	94	94	95	95	94
28	4.3 N	280.2	89	88	88	88	89	89	91	94	91	92	92
29	4.1 N	280.1	87	87	87	82	83	86	85	78	81	80	79
30	2.9 N	279.9	88	88	91	91	90	88	93	92	92	93	91
31	4.5 N	278.1	87	87	90	92	93	88	87	85	89	83	84
Nov. 1	6.1 N	276.0	91	93	93	90	91	91	89	85	86	88	85
2	4.6 N	277.7	86	86	86	87	91	96	97	88	88	86	81
3	3.7 N	278.5	93	93	93	90	87	87	87	87	84	86	90
4	2.5 N	278.9	81	80	81	81	81	80	83	81	82	85	79
5	1.6 N	279.2	81	80	82	82	85	85	83	85	83	81	81

humidity, Carnegie, 1928-29

wet- and dry-bulb readings

local mean hour													Mean
11	12	13	14	15	16	17	18	19	20	21	22	23	
													%
89	89	92	92	91	89	90	86	86	91	93	92	91	90.9
78	80	81	80	80	83	84	83	85	85	85	86	85	85.5
80	82	80	80	83	87	90	91	91	91	91	90	90	85.3
98	93	93	94	90	93	94	92	90	89	90	91	94	93.3
84	84	84	86	86	83	82	86	87	87	90	87	95	86.8
83	85	87	87	87	87	86	84	85	85	88	88	87	85.2
80	80	80	81	79	84	80	78	78	82	80	81	85	83.1
81	79	78	82	79	80	82	81	85	86	85	86	86	82.3
83	83	84	84	84	85	85	86	87	86	86	86	86	83.2
86	82	85	81	77	73	76	75	78	76	76	77	77	82.2
85	83	79	79	77	76	75	76	80	79	79	80	78	78.5
70	72	73	76	77	77	78	74	74	77	78	80	80	75.7
90	83	82	82	82	83	84	85	85	83	86	83	85	83.8
85	83	82	83	81	79	83	83	87	87	88	88	88	85.2
79	77	78	77	79	78	81	88	82	83	83	83	83	81.9
88	87	84	84	84	84	87	87	90	88	87	87	88	86.2
84	84	90	84	85	85	86	84	89	88	89	88	87	86.1
86	82	83	83	83	83	87	88	86	88	87	86	86	86.2
84	83	83	83	83	83	84	86	87	84	82	83	83	84.7
80	80	83	78	80	79	77	77	78	79	78	78	80	80.8
76	77	77	78	82	78	75	76	77	84	82	85	82	78.7
78	77	72	73	74	76	76	75	75	75	76	74	76	77.3
73	71	71	65	71	73	75	75	71	76	78	74	76	73.3
73	73	74	73	72	73	79	78	78	77	77	76	78	76.2
80	80	77	77	79	80	84	85	87	85	87	83	88	81.8
81	77	78	79	79	79	79	79	82	83	83	83	83	81.6
75	73	71	71	74	75	76	75	77	78	78	79	80	79.0
81	78	77	76	77	77	83	83	84	84	85	86	85	82.6
79	78	74	73	72	73	82	79	82	84	84	86	87	82.0
73	74	74	71	69	74	74	75	78	79	79	79	79	79.4
79	81	86	83	81	80	78	79	82	80	80	79	83	81.2
78	80	81	80	75	77	88	87	83	84	85	84	83	83.9
76	84	83	80	80	80	78	80	82	82	85	89	91	82.4
80	80	80	88	78	85	85	85	85	85	84	83	86	84.1
79	83	86	82	81	89	90	89	87	87	89	86	86	85.0
79	82	82	85	82	83	84	82	83	83	83	85	87	82.5
80	79	79	80	83	82	83	91	84	87	87	85	85	83.5
77	77	77	78	78	79	80	80	80	80	77	79	79	80.6
77	73	75	76	74	73	74	74	76	76	77	76	77	76.5
66	72	73	77	75	80	80	78	82	83	82	80	81	77.0
74	73	74	75	77	77	74	78	77	77	77	77	78	77.7
68	68	66	69	70	71	71	71	72	75	74	75	76	73.9
71	71	71	71	73	72	73	76	80	83	80	83	86	76.6
83	84	83	82	83	82	82	83	79	78	80	78	79	81.8
74	75	76	76	75	78	78	77	78	78	79	79	82	77.3
72	72	71	71	74	75	75	74	74	74	75	75	80	75.8
72	71	70	72	73	74	70	74	71	73	73	74	72	74.9
65	65	62	61	65	69	69	70	70	71	73	73	76	69.5
75	75	72	74	75	76	77	77	74	74	76	80	78	75.6
65	69	75	74	74	76	77	77	77	77	78	77	78	74.8
77	73	77	73	72	76	84	82	79	74	74	77	75	77.2
86	80	81	77	81	79	84	80	80	74	75	78	78	78.8
74	76	77	73	76	72	78	82	80	81	83	81	80	77.0
75	77	75	74	77	78	80	80	83	81	81	82	82	79.7
77	78	77	77	77	82	81	83	82	82	83	81	82	80.3
82	80	79	81	82	80	81	79	79	81	81	82	81	81.0
83	80	82	84	83	83	81	85	85	88	86	84	83	83.0
80	81	78	76	78	79	77	79	80	82	84	83	84	82.5
92	92	90	90	88	87	89	88	89	89	90	88	89	88.2
94	92	88	93	95	92	90	87	91	90	89	89	88	92.0
93	93	91	91	92	93	93	90	88	88	87	90	88	90.3
79	78	75	75	74	80	88	92	91	89	92	91	88	83.6
94	89	94	90	87	86	86	89	87	89	87	88	90	89.7
86	86	85	85	83	84	85	85	83	85	88	90	91	86.7
90	91	87	87	89	89	88	86	92	88	88	86	87	88.8
81	80	84	83	83	85	85	87	91	93	93	92	91	87.5
85	85	82	81	82	79	81	85	84	84	83	82	83	85.5
79	80	83	83	84	80	81	84	82	84	83	81	81	81.6
79	77	78	76	76	78	79	82	84	79	79	78	78	80.5

Table 81. Hourly values of relative

Date	Latitude	Longitude east	Values in per cent, 00	01	02	03	04	05	06	07	08	09	10
1928	°	°											
Nov. 6	0.8 N	278.8	78	78	77	78	78	77	86	87	85	85	86
7	0.5 S	278.0	84	83	83	83	86	86	86	84	86	86	82
8	1.5 S	277.7	90	92	89	88	89	87	88	89	87	87	86
9	1.3 S	275.2	86	85	90	87	90	90	88	87	87	86	87
10	1.6 S	273.0	84	84	85	83	84	85	86	84	84	84	81
11	1.9 S	271.0	77	77	76	78	78	71	72	76	77	72	72
12	1.3 S	268.7	76	76	76	76	76	76	77	78	75	72	71
13	1.5 S	266.9	81	83	82	80	82	79	78	81	80	78	77
14	1.8 S	265.7	78	87	84	83	80	79	77	85	84	81	79
15	2.5 S	264.2	87	87	87	88	87	86	86	85	84	83	82
16	3.1 S	261.8	86	86	86	86	93	90	93	92	89	86	84
17	3.3 S	260.2	90	90	90	92	90	91	86	86	80	79	74
18	4.0 S	257.4	83	81	84	85	85	86	83	82	74	67	77
19	4.6 S	254.5	67	70	75	80	80	69	67	77	75	70	73
20	7.0 S	253.1	80	78	79	79	78	77	80	80	75	75	78
21	9.2 S	251.6	80	81	81	82	88	95	79	79	77	76	75
22	12.0 S	249.8	78	78	79	79	84	85	82	78	76	74	75
23	14.2 S	248.1	74	75	77	78	78	77	69	78	77	80	74
24	16.7 S	247.0	83	80	79	78	79	79	77	72	77	75	76
25	19.2 S	245.9	75	75	77	78	78	83	79	78	77	75	74
26	21.6 S	245.6	97	98	98	98	99	98	78	84	75	80	75
27	23.3 S	245.2	80	85	80	80	83	81	81	73	78	80	78
28	24.8 S	244.7	82	81	84	87	92	86	86	87	79	79	77
29	26.6 S	244.7	77	78	79	80	77	77	77	72	73	75	73
30	28.1 S	244.9	80	80	80	68	79	83	86	87	89	80	82
Dec. 1	29.2 S	245.2	77	77	76	75	74	75	74	72	72	73	72
2	30.6 S	245.7	74	74	73	72	73	73	73	70	71	70	70
3	31.5 S	247.3	77	77	80	80	82	80	81	79	75	77	77
4	31.4 S	249.9	80	80	80	80	80	80	81	82	83	83	83
5	28.9 S	251.3	88	85	90	88	93	90	87	87	86	86	84
13	28.2 S	250.8	84	77	77	78	77	79	82	81	74	72	70
14	29.4 S	251.1	81	77	77	76	77	84	77	76	80	74	73
15	31.1 S	250.5	86	85	85	86	86	86	86	86	83	82	82
16	32.0 S	249.1	76	77	74	79	77	81	77	74	73	72	72
17	31.8 S	250.6	87	94	93	95	97	97	69	69	67	69	71
18	31.9 S	251.0	71	71	71	70	69	68	66	68	66	68	68
19	32.5 S	252.6	81	82	83	82	83	82	84	83	80	75	71
20	34.0 S	253.4	78	74	84	87	88	89	88	90	88	84	87
21	35.3 S	254.6	95	95	95	95	95	94	94	88	89	87	86
22	36.9 S	255.9	94	95	95	94	94	95	97	99	95	95	95
23	38.7 S	257.1	95	95	94	96	95	95	94	94	93	92	93
24	39.9 S	259.0	89	90	89	90	90	90	89	88	86	88	89
25	40.3 S	261.0	87	85	86	86	85	83	83	82	81	81	80
26	40.4 S	262.5	93	94	94	95	96	96	97	94	87	86	86
27	39.9 S	263.7	92	92	92	92	90	86	89	89	91	89	90
28	38.4 S	265.8	88	89	88	88	88	89	88	88	87	88	88
29	36.6 S	267.0	92	92	92	92	94	90	89	88	81	81	82
30	34.5 S	268.2	85	84	82	83	83	83	77	80	78	77	76
31	32.5 S	270.0	77	80	80	79	77	79	78	80	76	76	79
1929													
Jan. 1	32.2 S	270.9	76	76	76	76	77	76	75	74	73	73	69
2	31.9 S	271.1	70	70	69	70	71	70	66	67	68	69	70
3	31.9 S	271.7	72	72	70	70	69	68	65	62	64	64	64
4	31.8 S	272.7	72	73	72	70	72	70	68	66	65	65	63
5	31.0 S	273.4	69	71	72	75	75	76	76	75	75	76	76
6	28.9 S	274.7	79	79	73	80	78	80	81	77	75	75	76
7	27.0 S	276.0	81	82	81	78	76	77	76	76	76	72	71
8	25.0 S	277.8	74	77	72	69	65	68	68	68	68	67	63
9	23.1 S	278.8	75	74	75	76	75	76	78	79	80	79	75
10	21.4 S	279.5	83	78	80	80	81	80	80	80	81	79	77
11	19.1 S	280.7	82	77	77	76	81	82	83	84	82	74	74
12	16.7 S	281.4	76	74	70	73	73	71	72	74	71	70	74
13	14.1 S	282.1	81	81	80	81	82	82	82	79	80	79	79
14	12.3 S	282.8	86	85	85	86	88	86	88	85	84	81	79
Feb. 6	11.9 S	281.4	90	89	80	81	78	78	78	76	78	78	78
7	10.2 S	280.1	86	87	88	87	85	82	84	81	79	78	77
8	10.0 S	277.8	83	83	84	84	84	85	85	81	80	79	79
9	10.4 S	275.8	80	80	80	80	80	80	79	78	79	77	77
10	10.8 S	275.0	72	74	74	72	77	76	77	76	73	70	69
11	10.7 S	274.1	73	73	75	76	76	76	76	74	74	72	68
12	11.0 S	272.6	76	77	76	76	76	77	74	76	76	74	73
13	12.6 S	270.3	74	75	75	76	77	77	77	76	79	79	79
14	14.4 S	267.8	80	80	80	79	79	76	80	77	78	78	76

humidity, Carnegie, 1928-29--Continued

local mean hour													Mean
11	12	13	14	15	16	17	18	19	20	21	22	23	
													%
80	78	80	82	80	80	82	80	84	86	83	85	84	81.6
86	80	80	79	81	82	86	86	86	87	88	90	90	84.6
87	86	86	88	86	86	86	86	86	85	86	86	86	87.2
87	85	84	82	83	84	85	87	86	85	85	85	84	86.0
81	81	79	78	80	75	78	79	79	77	76	73	72	80.5
73	73	72	71	72	72	73	76	78	78	78	79	78	75.0
70	64	74	71	81	76	79	81	81	79	82	80	83	76.2
77	74	74	74	74	77	83	86	84	84	79	83	76	79.4
79	79	81	82	79	81	84	84	86	86	86	86	87	82.4
81	81	81	79	81	86	84	84	84	85	85	85	85	84.3
81	81	83	82	84	83	86	87	88	89	89	90	90	86.8
73	72	72	78	80	83	78	78	78	81	85	84	79	82.0
76	78	76	78	76	80	78	77	78	71	78	77	76	78.6
73	72	71	72	75	80	80	81	80	80	80	80	80	75.3
79	75	73	78	82	82	80	81	80	79	78	78	79	78.5
72	72	74	78	78	76	78	78	78	78	78	77	76	78.6
73	74	72	72	77	76	78	77	78	78	78	79	78	77.4
67	73	74	79	78	78	80	80	82	83	86	82	80	77.5
76	77	74	72	74	72	82	77	80	77	78	77	78	77.0
74	75	73	78	76	76	73	73	75	74	74	75	91	76.5
74	75	77	74	76	74	75	80	84	81	82	77	77	82.8
78	78	76	76	76	77	78	79	79	78	80	81	80	79.0
77	77	74	74	74	73	71	72	74	76	73	74	76	78.5
73	74	79	78	77	76	80	78	79	79	78	82	83	77.2
79	76	73	78	77	75	77	78	78	77	76	77	76	78.8
73	71	69	69	68	67	67	68	71	71	71	75	75	72.2
71	69	70	72	73	73	75	74	76	76	78	78	78	73.2
75	73	73	73	74	74	76	77	77	78	78	79	80	77.2
84	83	84	83	86	86	86	86	87	86	86	86	85	83.3
84	83	84	84	83	84	85	87	84	87	85	85	86	86.0
72	75	73	73	76	75	72	76	72	70	80	77	82	76.0
76	70	73	74	75	80	77	89	89	85	85	84	86	79.0
82	81	81	84	91	90	91	87	84	82	83	82	76	84.5
70	71	67	67	67	67	68	69	69	70	78	91	92	74.1
68	68	66	67	66	66	68	68	67	68	68	68	69	74.4
67	68	68	68	70	69	71	71	75	76	78	78	79	70.6
71	73	75	73	75	77	79	79	80	84	83	79	76	78.8
87	90	90	91	91	90	90	90	90	91	93	93	94	88.2
86	86	87	87	88	90	93	94	92	93	94	94	94	91.3
95	94	95	95	95	94	94	95	95	96	94	95	94	95.0
92	92	93	92	94	92	93	92	91	91	91	90	91	92.9
89	88	87	86	85	89	89	89	87	88	88	88	88	88.3
79	82	80	77	75	76	80	88	89	91	92	91	94	83.9
90	90	78	93	95	75	81	79	83	85	88	90	91	89.0
85	84	85	84	82	82	85	83	83	85	85	86	87	87.0
87	85	85	84	84	88	90	90	89	89	90	92	92	88.1
81	82	77	77	82	81	80	81	83	83	82	83	84	84.5
73	72	76	77	79	76	73	74	78	76	77	76	78	78.0
75	75	73	77	75	70	68	78	76	77	77	77	77	76.5
64	66	68	64	60	63	64	62	67	69	72	69	69	69.9
69	71	66	58	71	75	75	73	74	72	73	73	73	70.1
65	67	67	63	63	69	72	71	72	73	74	73	74	68.5
64	63	63	60	60	59	61	62	64	68	68	68	69	66.0
77	75	73	71	73	70	71	74	77	78	78	79	78	74.6
73	73	74	76	75	76	78	77	82	83	83	85	82	77.9
69	72	75	72	76	77	84	80	79	79	78	74	77	76.6
60	67	67	70	77	76	76	74	75	75	75	76	75	70.9
75	79	82	80	76	81	76	80	79	82	82	78	81	78.0
78	75	76	76	78	77	75	77	80	80	78	80	81	78.8
74	74	75	77	77	74	78	77	75	77	76	75	74	77.3
68	75	67	71	73	76	76	76	77	81	82	82	82	74.3
78	78	78	78	80	82	83	84	82	83	83	84	86	81.0
82	80	80	83	81	85	85	90	89	93	93	93	93	85.8
78	75	75	75	74	78	78	80	82	84	85	85	86	80.0
75	75	79	79	80	81	84	83	83	83	82	83	84	81.9
79	79	82	81	81	80	81	81	82	83	82	80	80	81.6
77	77	79	72	70	69	70	68	70	70	70	70	71	75.1
69	63	62	61	57	62	63	65	70	70	71	72	72	69.5
69	70	70	68	72	75	77	76	75	75	76	77	77	73.8
73	73	75	77	75	74	75	74	73	74	74	74	74	74.8
83	80	77	79	82	83	82	82	84	81	78	82	80	79.0
76	77	77	77	78	77	76	75	78	79	78	79	79	77.9

Table 81. Hourly values of relative

Date	Latitude	Longitude east	Values in per cent, 00	01	02	03	04	05	06	07	08	09	10
1929	°	°											
Feb. 15	15.8 S	265.1	77	78	79	77	79	72	77	80	79	78	77
16	15.3 S	262.4	78	79	78	78	79	78	78	77	76	76	78
17	14.8 S	259.2	78	80	83	78	80	87	80	84	81	79	79
22	12.6 S	247.7	73	73	74	73	74	73	74	74	76	75	72
23	12.5 S	244.9	76	73	74	75	74	76	76	75	72	70	73
24	12.7 S	242.4	77	76	77	77	76	76	78	76	76	72	72
25	12.8 S	240.6	72	73	72	72	73	73	75	76	75	73	72
26	13.0 S	238.7	76	77	74	73	73	73	73	72	71	74	75
27	13.5 S	235.9	74	74	78	75	76	73	74	74	73	71	71
28	14.9 S	233.8	76	76	76	76	76	76	74	76	72	72	73
Mar. 1	16.5 S	231.9	72	73	73	69	72	72	72	72	69	68	66
2	17.0 S	230.2	73	72	68	72	73	75	72	69	69	72	69
3	17.1 S	228.3	73	73	74	71	72	71	72	70	70	67	66
5	17.1 S	224.6	75	73	73	74	74	73	74	76	74	72	70
6	17.2 S	223.4	74	75	78	77	77	77	76	74	72	69	71
7	17.4 S	221.1	72	73	71	71	74	77	76	72	69	68	67
8	17.8 S	219.2	73	73	74	73	72	72	72	71	68	69	70
9	17.6 S	218.0	74	74	74	75	76	74	73	74	71	70	68
10	18.0 S	215.9	75	76	74	74	76	75	74	72	73	69	71
11	18.1 S	214.4	73	74	72	76	85	81	78	76	73	72	74
12	17.9 S	212.0	77	81	81	80	79	82	83	79	75	74	72
21	16.8 S	209.2	85	83	84	81	79	79	79	77	77	76	74
22	17.6 S	208.2	79	79	78	79	79	78	81	80	84	79	80
23	17.2 S	207.3	77	79	79	78	74	75	75	73	70	71	72
24	16.9 S	206.3	76	76	78	78	77	77	78	77	76	74	71
25	16.5 S	204.0	81	81	79	79	81	81	81	80	78	78	78
27	15.7 S	199.4	83	87	87	87	86	81	83	80	81	81	80
28	15.5 S	198.0	80	85	85	85	81	84	84	81	80	76	73
29	15.3 S	196.7	79	78	78	78	78	78	79	77	75	74	75
30	14.7 S	194.4	78	78	80	78	79	79	78	76	74	73	76
31	14.7 S	192.1	79	79	79	79	79	79	80	78	76	74	79
Apr. 22	12.7 S	188.4	79	78	76	78	77	78	78	80	77	81	81
23	11.3 S	188.4	82	82	81	81	80	77	78	77	75	75	76
24	8.7 S	189.0	80	80	79	81	80	78	81	79	80	78	78
25	7.6 S	188.2	79	77	77	79	83	84	86	86	83	79	80
26	6.7 S	187.6	86	79	78	78	76	77	78	77	74	71	70
27	5.1 S	187.6	74	74	74	74	74	74	81	81	77	72	71
28	3.8 S	187.4	75	75	74	74	76	76	75	73	75	74	71
29	1.8 S	186.6	78	80	81	81	78	79	79	78	80	78	80
30	0.4 N	185.9	89	87	82	79	81	81	82	82	81	82	80
May 1	2.5 N	184.9	82	82	82	82	87	85	86	88	88	83	85
2	4.4 N	183.6	85	82	81	80	82	80	80	80	81	85	84
3	6.5 N	182.3	83	86	86	87	86	83	82	81	80	78	78
4	8.2 N	181.1	85	81	84	82	83	80	80	79	79	81	78
5	10.8 N	180.5	80	82	80	79	80	79	79	79	77	77	77
7	13.5 N	177.4	80	77	78	78	79	82	79	78	76	74	76
8	15.4 N	174.7	82	80	80	80	80	80	78	78	76	78	78
9	16.5 N	171.9	79	80	78	78	79	78	79	78	79	79	80
10	18.5 N	169.0	81	80	80	82	83	81	82	79	76	75	75
12	20.3 N	163.7	78	75	80	80	76	75	82	79	83	83	79
13	20.2 N	161.2	79	77	76	78	77	78	77	73	75	74	76
14	19.5 N	158.5	79	80	78	80	80	80	80	78	78	77	77
15	18.7 N	156.1	85	83	85	84	84	84	85	86	85	84	83
16	17.5 N	153.4	79	79	79	83	81	81	79	80	78	78	78
17	16.1 N	150.9	82	83	82	81	81	81	81	83	84	79	78
18	14.9 N	148.3	80	82	82	79	79	79	79	77	76	75	73
19	14.0 N	146.0	80	79	79	79	79	78	79	76	77	79	79
26	16.1 N	144.2	77	80	82	80	78	78	78	75	77	74	72
27	18.6 N	144.0	77	78	77	78	78	79	77	75	75	73	73
28	21.5 N	144.2	74	73	73	70	73	74	74	75	70	69	74
29	23.4 N	144.2	77	79	78	78	84	80	79	79	74	74	74
30	25.3 N	144.1	92	87	85	84	87	84	78	79	79	75	72
31	26.4 N	144.4	88	88	89	91	92	90	91	90	89	89	90
June 1	28.5 N	144.0	94	94	93	94	94	93	95	93	92	90	87
2	30.2 N	143.9	90	92	90	93	92	91	90	91	90	90	92
3	31.1 N	144.3	85	84	87	88	88	86	86	84	85	85	85
4	32.7 N	142.3	91	90	88	90	92	91	90	91	91	90	89
5	34.0 N	141.2	91	90	90	90	89	88	86	82	85	85	81
6	34.9 N	140.2	94	95	95	94	94	59	95	96	96	95	94
7	34.9 N	139.9	85	85	79	81	79	81	82	81	82	88	86
25	34.7 N	141.0	84	82	82	80	86	89	86	84	81	78	78

humidity, Carnegie, 1928-29--Continued

local mean hour													Mean
11	12	13	14	15	16	17	18	19	20	21	22	23	
													%
71	72	72	65	73	76	76	78	78	78	78	78	79	76.1
75	75	72	75	71	72	77	74	76	76	76	78	79	76.3
77	74	72	73	76	77	75	77	77	78	79	78	77	78.3
74	72	71	71	71	72	74	75	76	75	76	75	73	73.6
73	73	69	71	72	72	74	74	75	74	76	74	76	73.6
69	71	71	71	71	71	68	69	69	70	70	72	71	72.8
71	69	70	71	71	72	74	74	74	74	76	72	73	72.8
75	74	72	73	69	73	72	72	74	76	76	76	75	73.7
68	66	65	67	72	73	72	71	72	73	75	74	74	72.3
73	73	70	66	68	69	69	71	71	71	71	72	72	72.5
66	66	67	67	68	70	68	71	69	72	71	71	72	69.8
72	68	66	72	72	70	70	70	73	72	73	74	73	71.2
68	67	66	68	68	68	70	73	71	71	75	75	75	70.6
68	68	69	69	70	66	72	73	76	77	73	75	71	72.3
70	69	67	71	67	65	65	68	67	67	72	73	70	71.3
67	67	66	67	67	66	70	71	72	71	69	71	72	70.2
68	69	70	68	68	69	73	70	71	72	72	72	74	71.0
67	67	67	69	69	70	72	73	72	74	74	73	74	71.8
71	71	66	66	79	80	76	78	74	69	75	75	72	74.2
78	74	75	84	82	85	82	78	78	74	73	73	75	76.9
72	74	74	79	76	75	74	70	75	79	79	92	89	78.0
75	73	75	82	83	77	79	82	81	77	77	80	81	79.0
81	79	78	77	76	75	71	75	74	76	77	77	77	77.9
73	68	68	68	71	72	71	70	72	74	74	75	75	73.1
75	73	73	74	78	77	78	77	78	79	79	79	82	76.7
76	76	77	78	74	78	79	81	81	83	81	84	83	79.5
80	80	81	78	80	81	80	81	77	79	79	80	81	81.4
71	71	70	70	73	69	72	73	75	76	79	80	78	77.1
72	69	67	70	74	73	75	74	74	76	78	78	78	75.3
73	72	67	79	81	79	76	81	87	86	82	80	79	78.0
76	75	76	76	75	78	79	76	75	80	80	81	80	77.8
79	77	77	75	77	91	91	88	84	86	88	87	84	81.1
76	77	77	78	79	79	81	80	80	80	81	80	78	78.8
77	81	80	87	84	82	78	78	79	80	78	79	77	79.8
81	74	71	68	74	72	77	77	79	81	81	82	85	79.0
70	69	80	79	80	79	74	73	71	81	81	76	74	76.3
66	68	69	68	79	76	79	75	78	78	79	80	74	74.8
72	73	74	75	76	77	77	77	79	78	78	78	78	75.4
79	79	80	81	80	79	79	81	82	82	82	82	87	80.2
81	78	77	77	79	79	79	80	80	82	82	83	82	81.0
81	82	81	79	82	81	81	83	82	83	83	88	87	83.5
82	81	80	81	81	80	92	92	88	88	84	84	84	83.2
77	77	77	85	80	85	84	80	81	81	84	87	86	82.2
78	82	80	79	81	82	81	81	92	87	86	83	81	81.9
76	76	77	79	78	78	81	79	83	83	83	78	79	79.1
76	79	79	79	82	82	80	80	80	80	80	81	84	79.1
77	74	78	78	80	80	80	80	80	80	79	81	83	79.2
81	81	78	80	78	79	84	82	82	82	84	81	83	80.1
73	74	72	74	74	77	74	74	74	74	74	75	78	76.7
74	76	73	72	71	73	73	77	77	77	79	79	80	77.1
73	74	76	72	76	78	77	78	78	79	79	78	79	76.5
77	75	74	74	80	74	75	76	76	79	80	79	80	77.8
79	77	79	79	79	79	80	79	81	80	79	79	80	81.6
78	76	78	79	78	79	80	82	79	82	82	84	82	79.8
77	75	74	76	77	77	77	77	80	82	82	81	82	79.7
71	73	74	79	79	79	78	79	78	80	80	78	79	77.8
75	74	74	74	76	75	77	79	81	80	80	80	80	77.9
73	73	73	74	76	76	77	73	75	75	77	74	75	75.9
72	74	74	75	75	74	74	76	77	77	78	73	76	75.6
72	73	74	74	72	73	73	74	76	77	78	75	75	73.5
77	75	77	77	78	79	79	81	84	84	86	87	91	79.6
77	76	77	73	74	77	80	80	82	83	83	85	89	80.8
87	86	82	82	82	83	84	84	87	91	91	91	93	87.9
83	83	87	87	85	89	89	91	93	93	92	93	92	90.7
88	86	85	82	81	79	81	83	84	82	84	81	84	86.7
82	84	85	86	86	87	87	90	91	92	91	91	92	87.0
88	90	87	87	88	88	92	92	90	89	89	88	91	89.7
80	83	82	80	83	84	84	85	93	91	91	91	91	86.5
94	88	86	87	85	82	80	81	83	84	84	84	84	89.4
84	78	78	77	78	84	81	81	81	84	84	83	83	81.9
78	89	81	78	76	78	76	76	78	82	86	88	87	81.4

Table 81. Hourly values of relative

Date	Latitude	Longitude east	Values in per cent, 00	01	02	03	04	05	06	07	08	09	10
1929	°	°											
June 26	36.0 N	142.1	89	90	93	94	93	93	92	92	89	84	85
27	36.7 N	143.6	92	95	95	94	94	93	91	91	91	89	87
28	36.8 N	145.4	90	91	92	92	92	94	95	93	92	91	88
29	37.8 N	145.5	86	87	86	86	87	86	82	82	82	81	80
30	38.1 N	147.1	77	82	80	86	86	82	84	85	84	80	87
July 1	38.7 N	147.7	86	88	88	89	91	91	91	88	85	81	80
2	39.8 N	149.5	77	77	77	78	77	77	78	78	78	74	76
3	40.4 N	151.1	83	80	78	82	85	83	81	83	82	80	77
4	41.3 N	153.1	83	83	85	83	85	86	87	89	90	92	91
5	42.6 N	155.6	95	96	96	96	98	98	99	98	98	95	95
6	43.8 N	158.3	98	96	98	98	98	96	96	96	96	96	98
7	45.4 N	159.6	95	94	95	95	95	96	96	96	98	95	95
8	46.9 N	163.0	96	96	98	96	96	95	96	97	97	96	96
9	47.0 N	166.6	96	95	99	97	96	96	97	97	99	97	96
10	46.7 N	169.5	97	99	99	97	97	97	96	97	97	96	95
11	46.0 N	171.7	95	95	96	93	95	95	95	96	95	95	95
12	45.3 N	173.1	95	95	95	96	96	96	95	96	96	96	96
13	46.2 N	174.1	96	98	96	96	96	97	98	95	98	96	96
14	48.1 N	178.1	98	98	98	98	99	98	99	100	99	99	98
14	49.2 N	183.3	95	95	95	96	95	96	99	100	98	98	98
15	50.5 N	187.2	96	98	95	93	90	88	89	94	95	95	96
16	51.4 N	192.7	95	94	95	95	93	94	96	99	98	95	94
17	52.4 N	198.2	96	96	98	96	96	96	96	95	95	98	96
18	52.6 N	204.4	96	100	98	98	99	100	100	100	99	99	98
19	52.0 N	209.6	95	94	95	96	96	96	95	98	97	96	98
20	50.2 N	213.9	95	95	95	96	96	96	96	95	96	96	98
21	48.0 N	217.3	96	96	98	94	93	93	93	91	90	92	86
22	46.0 N	220.3	87	91	87	89	87	89	90	90	91	91	87
23	44.3 N	222.4	87	84	82	85	91	94	86	84	85	82	84
24	42.6 N	224.8	79	77	86	77	80	80	77	80	77	84	79
25	40.7 N	227.7	78	76	76	77	74	76	76	73	76	79	83
26	39.6 N	230.5	95	90	93	90	86	91	83	79	78	75	76
27	38.8 N	234.3	79	80	78	81	84	84	85	86	86	86	86
28	38.2 N	237.2	92	92	91	94	93	94	94	93	93	91	89
Sep. 4	37.0 N	236.3	87	87	86	83	83	82	82	84	84	87	86
5	35.5 N	235.0	82	81	77	77	78	79	80	79	77	78	75
6	33.8 N	233.7	87	85	86	84	85	84	83	86	86	86	85
7	32.4 N	232.1	83	87	84	82	83	83	76	79	74	70	68
8	31.6 N	231.2	76	72	68	66	73	70	76	75	75	72	68
9	30.4 N	229.0	69	67	66	70	70	71	70	71	67	70	71
10	29.3 N	227.4	70	68	70	68	69	66	68	67	65	67	63
11	28.2 N	225.7	66	63	66	66	69	70	71	70	68	67	64
12	27.7 N	224.6	67	67	68	68	68	68	68	68	68	68	63
13	27.0 N	222.3	64	65	66	67	65	69	70	69	69	69	68
14	26.7 N	220.9	81	82	78	77	77	75	75	74	75	76	78
15	26.5 N	219.4	74	74	75	77	76	77	75	75	75	80	77
16	26.2 N	217.9	76	77	77	77	77	77	77	75	73	73	72
17	25.1 N	216.4	72	76	74	74	74	74	75	71	69	67	64
18	24.0 N	214.4	80	81	72	76	71	72	70	69	66	69	64
19	23.4 N	211.3	71	71	70	71	71	71	70	71	66	67	65
20	22.9 N	208.6	77	72	70	66	73	72	72	72	71	72	64
21	22.3 N	206.4	76	78	77	76	76	79	80	71	71	70	75
22	21.7 N	204.3	78	79	78	81	80	80	79	73	74	74	74
23	21.3 N	202.1	78	77	78	78	78	78	78	75	77	72	69
Oct. 3	23.5 N	200.4	83	81	79	78	79	77	77	75	73	71	71
4	26.4 N	199.5	72	72	71	72	72	71	71	71	70	69	71
5	29.1 N	198.8	70	70	72	76	76	78	73	72	74	72	73
6	31.7 N	199.0	75	76	76	77	75	76	77	77	76	76	76
7	32.8 N	199.3	77	78	80	82	80	79	79	76	72	70	69
10	33.6 N	205.5	71	71	70	69	68	70	71	71	70	69	67
11	33.7 N	208.3	80	83	84	87	84	85	85	83	84	86	85
12	33.3 N	212.3	88	86	85	84	88	86	85	85	87	92	91
13	33.4 N	214.6	85	80	87	87	84	82	83	82	82	74	77
14	33.6 N	216.9	71	71	73	74	75	77	78	78	77	76	79
15	31.8 N	219.3	82	83	82	83	81	80	81	81	81	80	81
16	29.1 N	220.8	78	76	77	76	77	83	84	86	85	79	81
17	27.4 N	221.9	80	80	80	79	79	78	78	76	75	73	73
19	25.0 N	222.2	79	78	85	85	82	80	85	77	72	73	74
20	23.2 N	221.7	88	92	87	88	87	84	85	83	81	80	81
21	21.2 N	221.5	77	77	76	78	75	78	78	75	75	76	73
22	18.3 N	222.0	81	81	79	81	79	82	82	78	76	74	74
23	16.2 N	223.0	73	73	73	76	75	72	71	70	70	70	68

humidity, Carnegie, 1928-29--Continued

local mean hour													Mean
11	12	13	14	15	16	17	18	19	20	21	22	23	
													%
86	86	87	87	87	88	88	88	92	91	95	94	92	89.8
88	85	84	86	85	85	85	89	91	92	91	92	91	89.8
86	89	90	84	94	99	96	97	90	90	87	87	82	90.9
78	79	79	78	77	77	79	78	77	77	77	78	79	80.8
81	81	86	89	90	88	91	88	88	88	88	88	90	85.4
79	81	78	78	79	78	80	77	76	77	80	79	78	82.4
77	77	79	79	79	82	82	81	84	83	82	80	81	78.9
79	84	80	80	81	78	80	79	78	81	84	85	83	81.1
88	89	87	87	87	87	91	93	94	94	95	95	97	89.1
94	96	95	94	95	96	96	95	98	98	98	99	96	96.4
96	96	95	98	96	96	95	96	95	96	95	96	95	96.3
96	96	96	97	96	96	96	96	96	98	97	96	97	96.0
90	94	89	90	90	95	93	92	97	97	96	96	95	94.7
95	94	92	94	93	95	95	96	97	97	97	97	100	96.1
92	92	92	92	88	87	90	88	91	92	93	94	94	93.8
92	88	89	91	90	90	89	88	92	94	95	96	97	93.2
96	95	94	93	92	90	90	94	95	95	95	95	96	94.7
98	97	98	98	98	98	96	95	95	96	96	98	98	96.8
98	95	95	96	96	99	99	99	98	96	96	98	98	97.8
96	98	98	95	96	99	99	96	96	96	97	97	96	96.8
95	93	94	93	93	95	96	95	95	95	96	95	93	94.0
95	95	95	95	94	93	93	94	94	95	95	95	95	94.8
95	94	91	92	91	93	94	96	98	98	98	97	97	95.5
96	95	94	94	94	94	95	95	96	96	95	95	95	96.7
98	98	95	95	95	95	95	98	98	98	96	96	96	96.2
96	95	92	92	91	93	94	94	94	94	94	94	96	94.7
86	83	85	84	81	81	84	89	86	90	90	87	87	89.0
87	81	82	84	80	85	83	82	83	83	90	91	86	86.5
84	82	74	75	76	77	76	77	79	82	81	80	79	81.9
79	75	77	81	76	79	78	79	85	78	83	80	80	79.4
81	82	83	84	84	86	87	88	89	89	91	93	95	82.3
81	78	76	78	79	79	79	73	78	73	76	78	78	80.9
86	84	84	84	85	86	86	85	85	90	89	90	92	85.0
90	90	86	86	88	89	88	88	88	95	96	97	97	91.4
83	82	82	80	77	79	76	77	78	79	79	79	79	81.7
75	74	77	72	69	73	73	75	76	77	79	82	84	77.0
76	81	79	82	81	84	81	80	76	81	74	79	77	82.0
66	75	74	71	69	69	69	77	76	74	74	73	74	75.4
66	65	63	64	64	68	73	75	74	70	75	69	69	70.2
65	67	67	68	69	68	69	70	69	71	69	69	69	68.8
67	63	63	64	64	64	66	69	70	69	70	68	68	66.9
61	58	59	60	57	60	61	61	65	68	70	71	66	64.9
61	63	59	64	63	62	62	61	64	64	64	64	64	64.8
65	66	64	59	62	63	58	64	66	68	68	68	69	65.9
72	72	74	70	70	71	74	73	74	75	72	74	75	74.8
77	77	77	77	75	75	75	76	77	77	77	77	77	76.2
71	71	72	71	71	70	68	68	71	71	72	74	74	73.1
68	65	65	68	69	71	71	70	72	72	73	73	73	70.8
64	69	66	66	68	70	70	71	71	71	70	73	71	70.4
63	61	64	63	62	65	66	68	67	68	69	72	77	67.9
66	66	68	70	71	72	71	73	72	71	71	74	75	70.9
80	73	71	71	75	74	75	78	78	79	77	82	76	75.8
73	73	67	70	72	76	78	79	77	78	79	77	78	76.1
71	64	65	65	64	64	64	65	61	58	70	70	72	70.5
73	75	70	69	72	78	74	74	75	73	75	72	71	74.8
69	69	70	70	69	73	72	73	74	74	70	71	70	71.1
72	71	71	71	76	80	81	78	83	76	78	76	76	74.8
74	73	76	77	76	77	77	80	80	80	79	80	80	76.9
69	74	77	78	80	81	83	84	84	84	85	85	88	78.9
68	67	63	64	65	67	67	70	74	76	74	84	80	70.2
78	81	81	78	81	79	83	84	87	87	84	87	86	83.4
91	91	94	93	92	89	90	86	85	94	91	88	86	88.6
79	77	70	65	64	68	66	69	68	68	69	70	70	75.2
78	78	83	83	81	78	77	76	76	76	80	80	81	77.3
83	83	87	83	83	89	81	77	75	75	76	77	76	80.8
79	82	83	85	86	90	92	92	90	88	91	89	84	83.9
73	70	71	69	64	63	64	69	71	74	75	75	75	73.5
72	80	80	83	84	80	80	81	82	84	85	85	86	80.5
76	77	75	77	78	79	78	78	77	77	77	77	78	80.8
74	75	76	77	80	78	81	82	78	81	79	79	78	77.3
75	75	76	76	77	76	76	77	77	75	75	74	75	77.1
70	70	71	71	71	74	74	74	75	76	77	77	77	72.8

Table 81. Hourly values of relative

Date	Latitude	Longitude east	Values in per cent,										
			00	01	02	03	04	05	06	07	08	09	10
1929	°	°											
Oct. 24	13.6 N	223.5	76	83	81	84	87	89	88	89	85	87	85
25	12.7 N	222.5	87	88	86	88	86	84	81	85	87	89	86
26	11.3 N	221.3	80	80	79	79	79	77	75	75	73	71	72
27	10.1 N	220.3	82	78	79	77	81	81	81	79	75	72	73
28	8.6 N	219.2	84	86	86	80	80	81	81	83	77	75	76
29	7.7 N	218.6	80	80	79	84	83	84	82	82	79	79	76
30	7.1 N	217.4	83	82	85	83	82	82	81	79	80	78	79
31	6.7 N	216.6	91	92	90	86	87	87	86	82	82	79	78
Nov. 1	5.8 N	215.3	84	84	80	79	80	86	85	85	88	85	88
2	4.9 N	213.2	78	78	78	77	79	79	83	79	78	77	77
3	4.3 N	210.7	83	83	83	80	80	80	80	80	79	79	77
4	3.0 N	210.2	78	80	81	80	80	80	78	79	76	77	77
5	0.8 N	208.5	81	81	81	82	81	83	82	83	79	79	79
6	1.8 S	207.6	81	81	82	81	81	82	81	79	78	78	77
7	4.9 S	206.6	78	78	77	77	75	77	76	75	71	70	69
8	6.6 S	204.9	77	77	77	77	77	76	74	74	74	74	73
9	8.1 S	203.1	75	75	76	76	75	76	74	76	72	70	68
10	9.0 S	201.9	78	78	76	74	74	74	75	72	73	71	72
11	9.4 S	200.9	76	74	78	76	78	76	74	74	74	74	72
12	10.3 S	198.9	75	75	76	76	78	76	77	76	79	72	70
13	11.0 S	198.0	76	75	75	75	74	75	79	87	87	83	78
14	11.6 S	196.6	70	72	72	72	74	72	72	69	65	65	61

humidity, Carnegie, 1928-29--Concluded

local mean hour													Mean
11	12	13	14	15	16	17	18	19	20	21	22	23	
													%
85	87	85	83	86	85	86	85	84	83	87	89	87	85.2
87	81	89	90	85	86	86	86	84	83	80	80	78	85.1
72	71	69	66	66	73	83	78	79	81	81	81	82	75.9
70	71	73	73	72	69	85	87	83	83	83	83	83	78.0
76	74	70	73	72	78	78	81	80	83	81	81	80	79.0
79	74	83	76	76	77	77	78	77	77	77	80	85	79.3
80	80	88	83	82	83	81	82	88	90	90	91	92	83.5
75	75	83	78	79	80	79	79	79	79	79	86	80	82.1
86	81	85	86	84	79	79	78	78	80	80	79	78	82.4
77	76	77	78	79	77	75	76	78	77	78	79	81	78.0
76	77	77	73	72	73	74	74	74	74	75	76	74	77.2
77	77	75	76	76	77	74	77	77	77	78	79	81	77.8
79	78	79	80	81	81	82	82	81	81	81	80	81	80.7
76	76	75	77	77	77	80	80	78	78	77	79	77	78.7
68	69	67	72	69	68	70	75	75	75	75	75	76	73.2
72	72	71	72	73	73	71	74	74	74	75	76	76	74.3
71	70	69	69	68	72	74	75	76	77	78	78	78	73.7
72	74	73	71	70	72	72	72	74	74	74	74	75	73.5
71	72	71	71	71	72	71	73	72	74	74	75	74	73.6
70	69	72	70	72	72	69	70	71	73	72	72	72	73.1
68	67	66	66	67	67	68	70	70	69	69	68	68	72.8
57	57	55	57	55	53	60	65	64	65	67	73	74	65.2

FIGURES 1 - 62

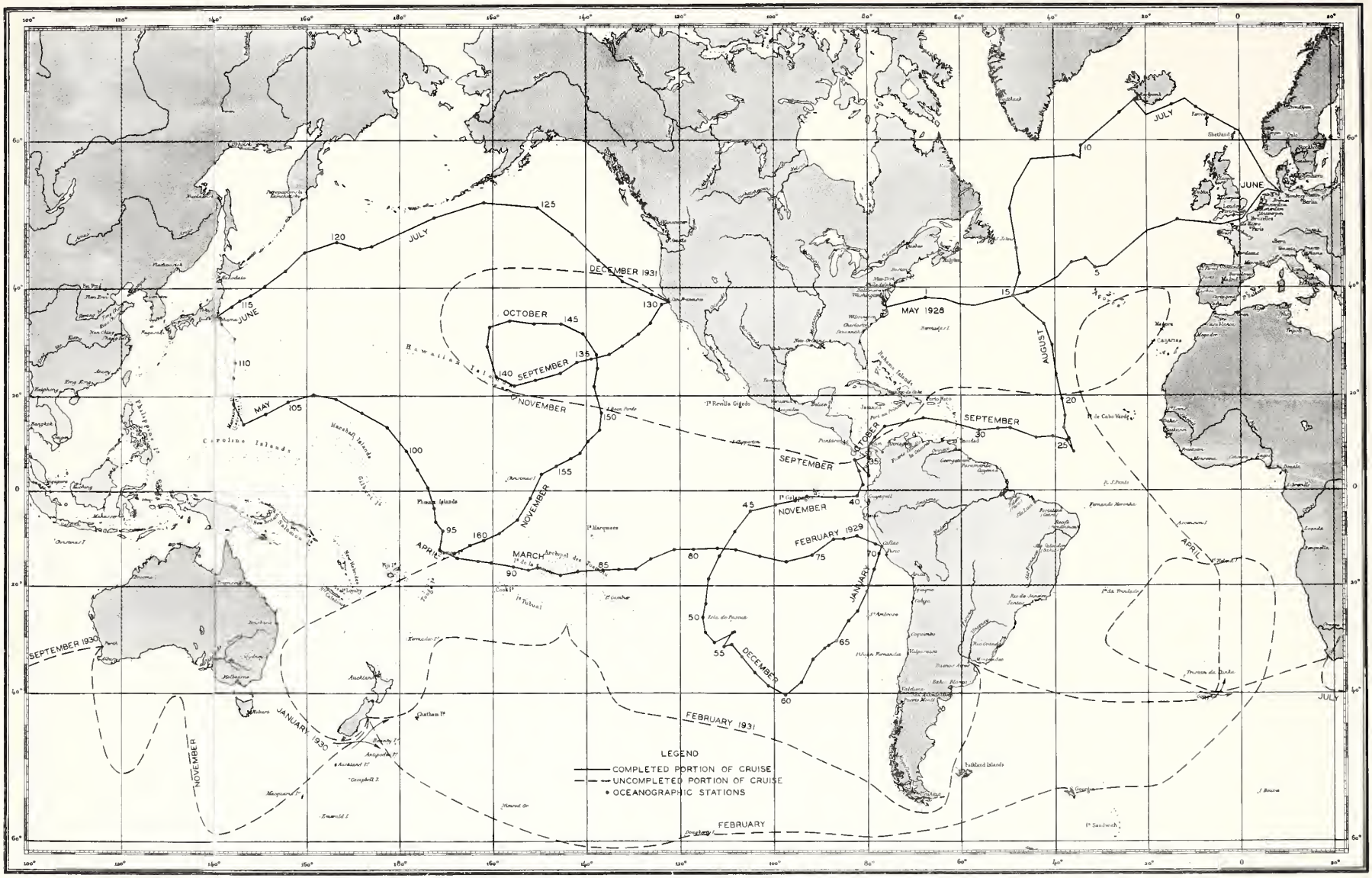


FIG. 1—ROUTE OF THE CARNEGIE SHOWING COMPLETED AND UNCOMPLETED PORTIONS OF CRUISE VII

FIG. 2— THE CARNEGIE SHOWING LOCATIONS OF METEOROLOGICAL INSTRUMENTS

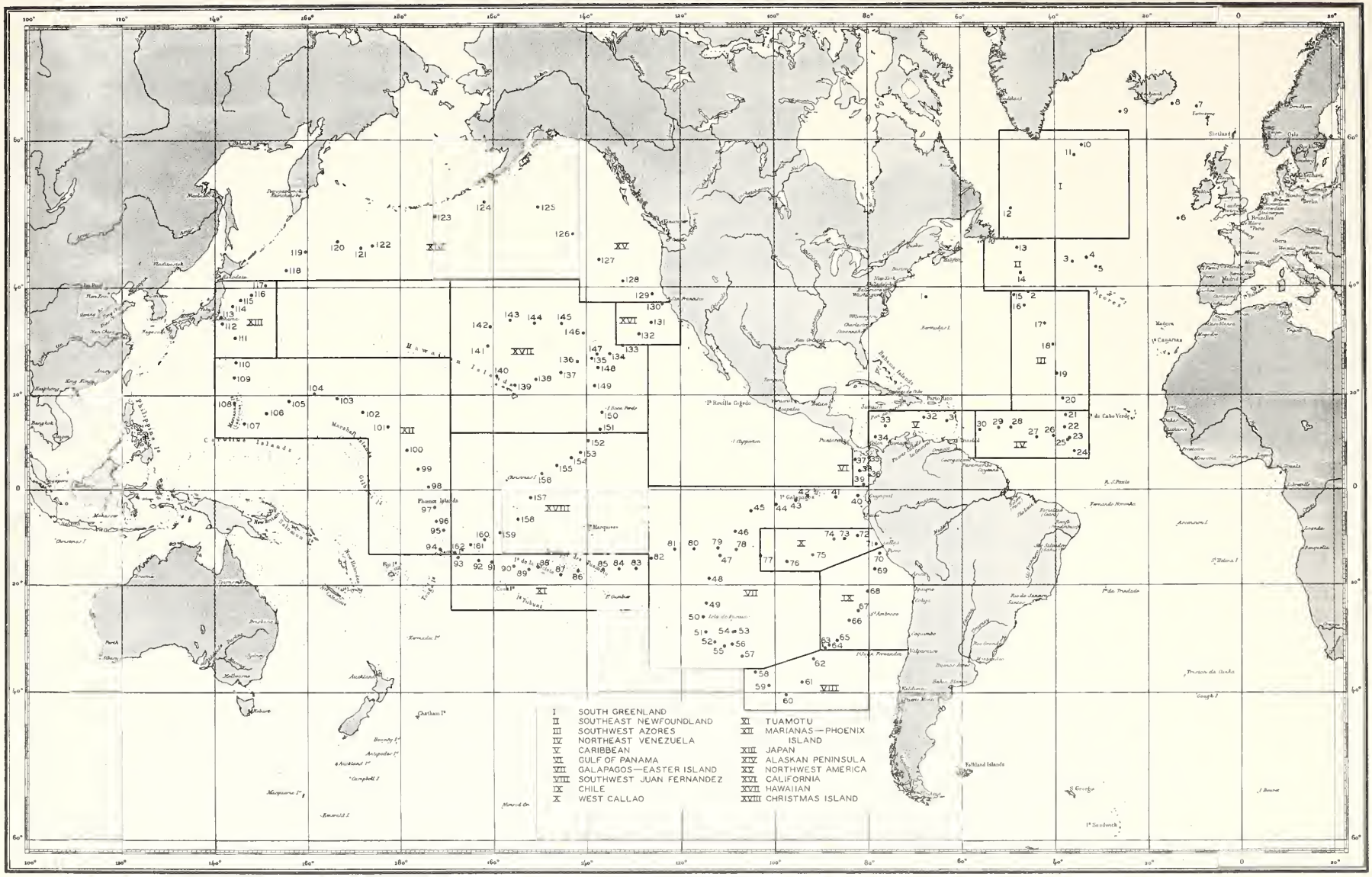


FIG. 3—GROUPS OF CARNEGIE DATA

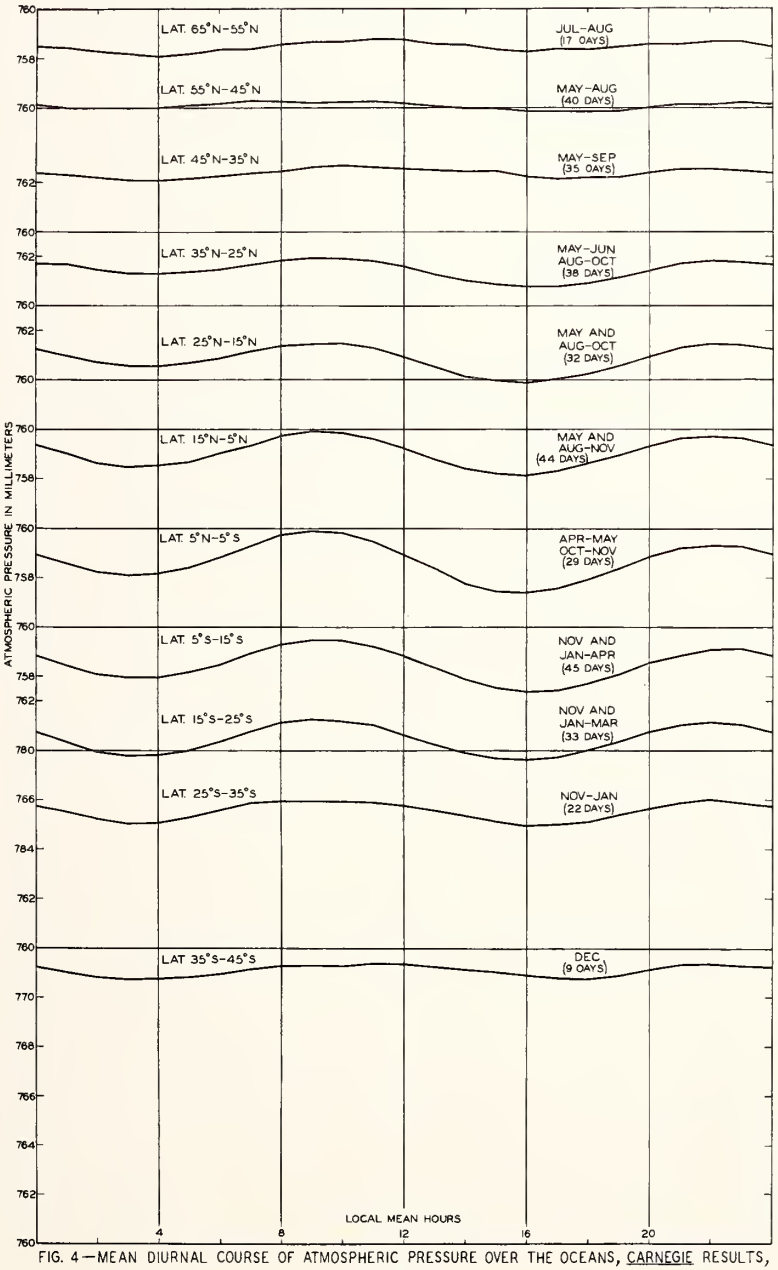


FIG. 4—MEAN DIURNAL COURSE OF ATMOSPHERIC PRESSURE OVER THE OCEANS, CARNEGIE RESULTS, 1928-1929

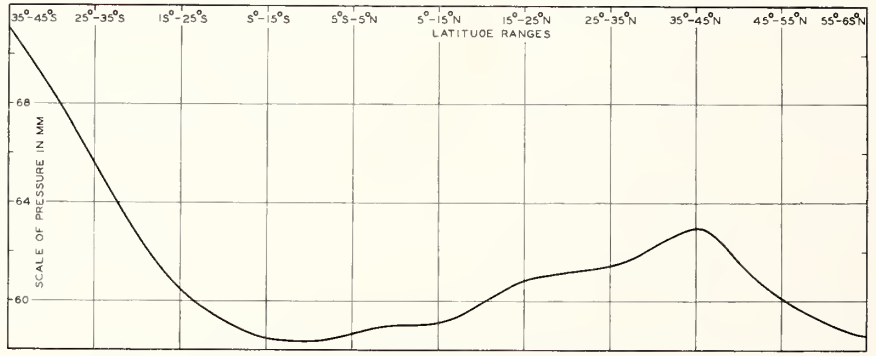


FIG. 5—MEAN ATMOSPHERIC PRESSURE FOR LATITUDE RANGES, FROM CARNEGIE RESULTS, 1928-1929

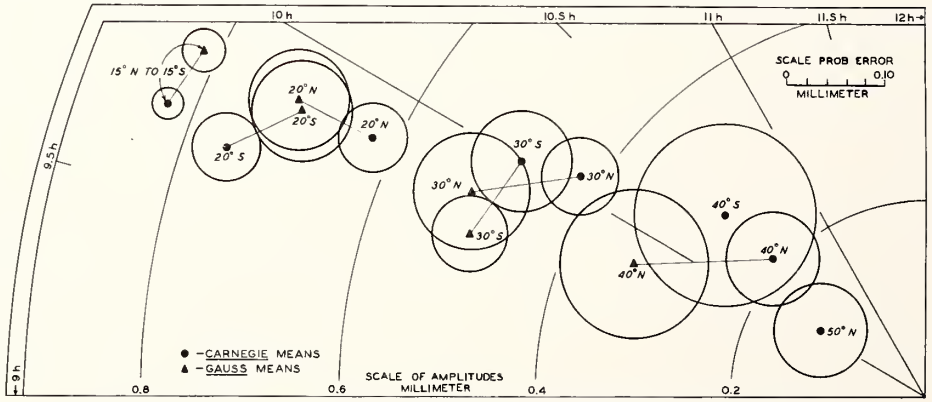


FIG. 6—HARMONIC DIAL COMPARING 12-HOURLY WAVES ATMOSPHERIC PRESSURE FROM OBSERVATIONS MADE ON THE GAUSS (1901-1903) AND ON THE CARNEGIE (1928-1929)

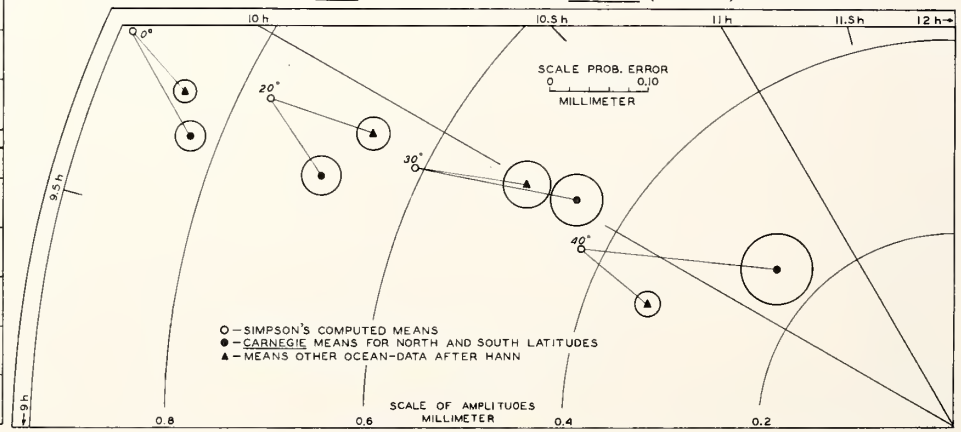


FIG. 7— HARMONIC DIAL COMPARING 12-HOURLY WAVES ATMOSPHERIC PRESSURE AT SEA AND AFTER SIMPSON

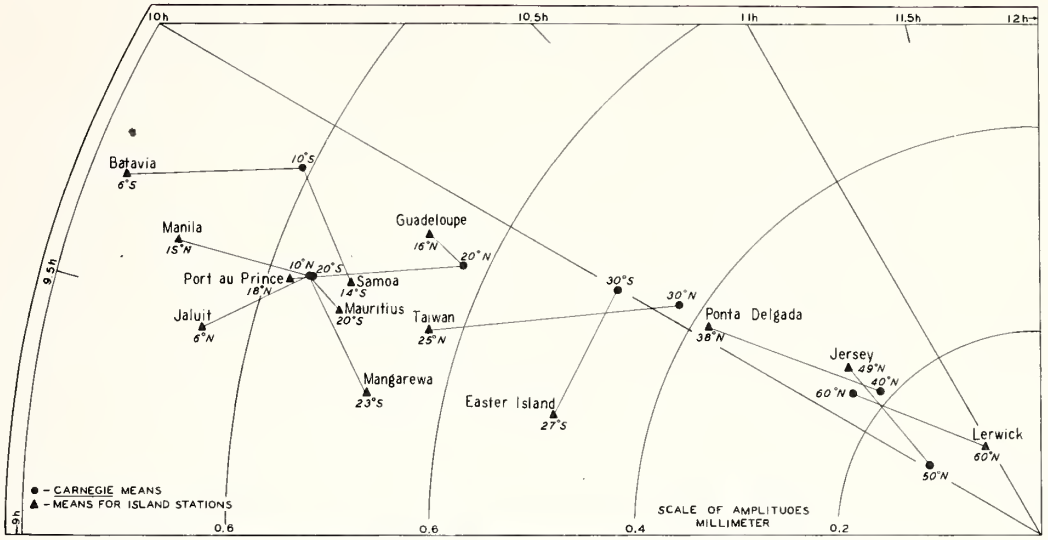


FIG. 8—HARMONIC DIAL COMPARING 12-HOURLY WAVES ATMOSPHERIC PRESSURE AT APPROXIMATELY SAME LATITUDES FOR STATIONS ON ISLANDS AND AT SEA

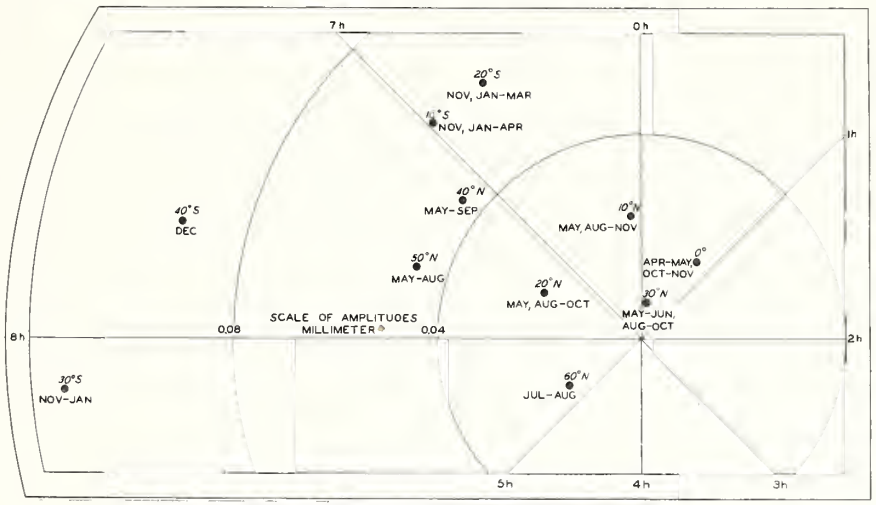


FIG. 9—HARMONIC DIAL OF 8-HOURLY WAVES ATMOSPHERIC PRESSURE FROM OBSERVATIONS MADE ON THE CARNEGIE (1928-1929)

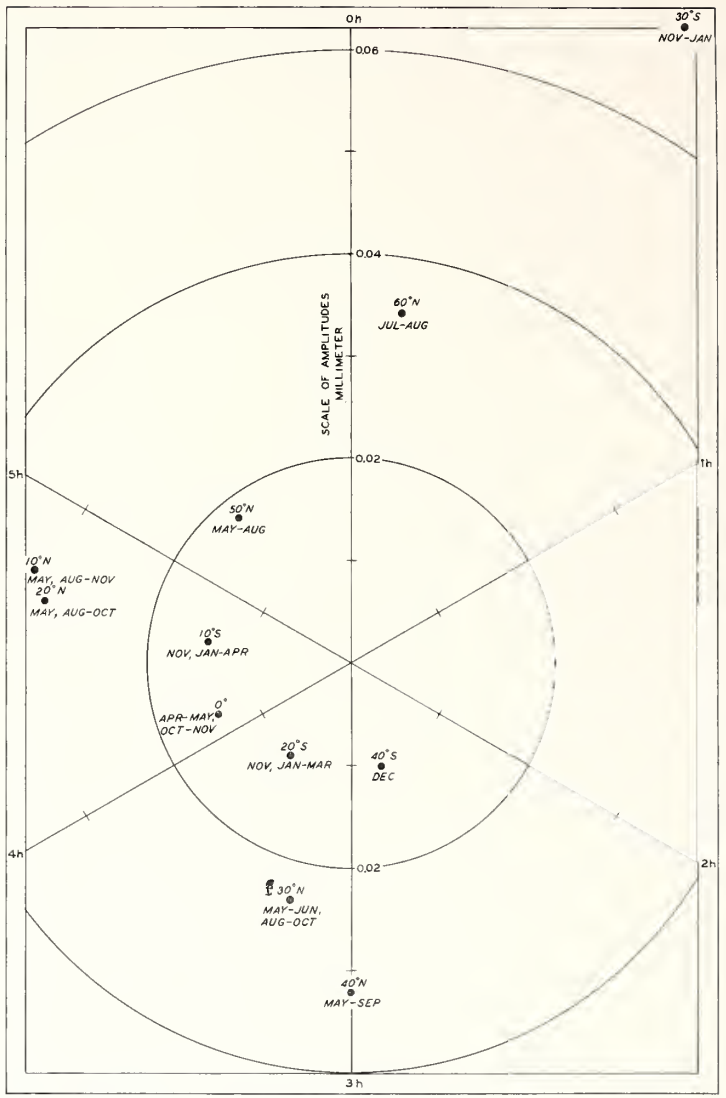


FIG. 10—HARMONIC DIAL OF 6-HOURLY WAVES ATMOSPHERIC PRESSURE AT MEAN LATITUDES FROM OBSERVATIONS MADE ON THE CARNEGIE (1928-1929)

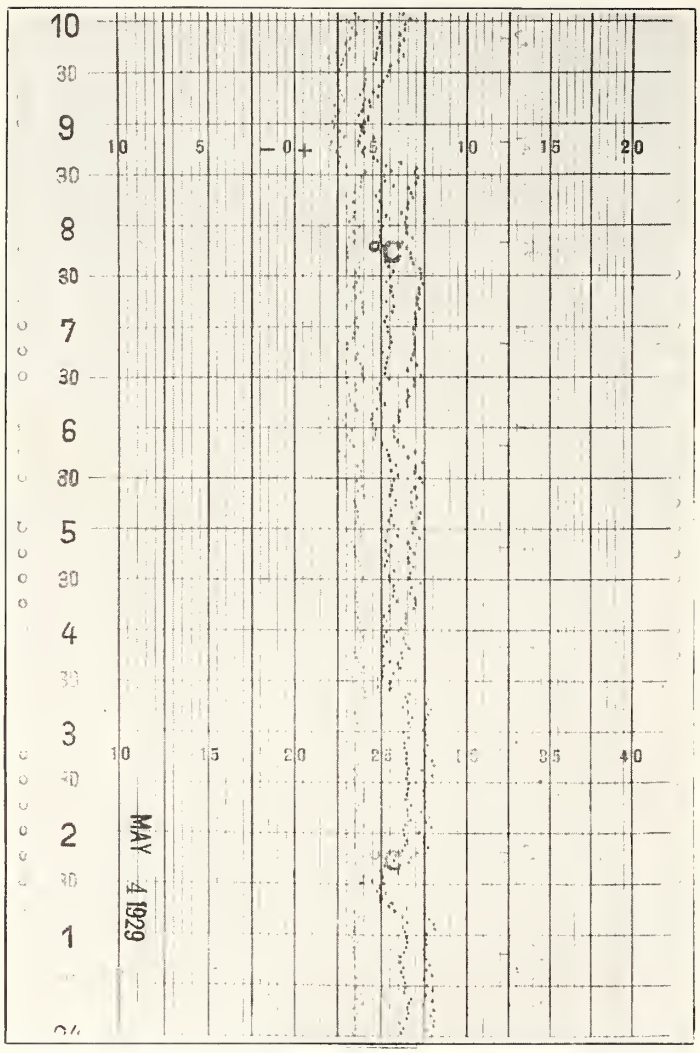


FIG. 12—SAMPLE HARTMANN AND BRAUN TRACE; NOTE SEVERAL RAINSTORMS DURING DAY INDICATED BY DEPRESSIONS IN CURVES [REPRODUCTION IS TWO-THIRDS SIZE OF RECORD]

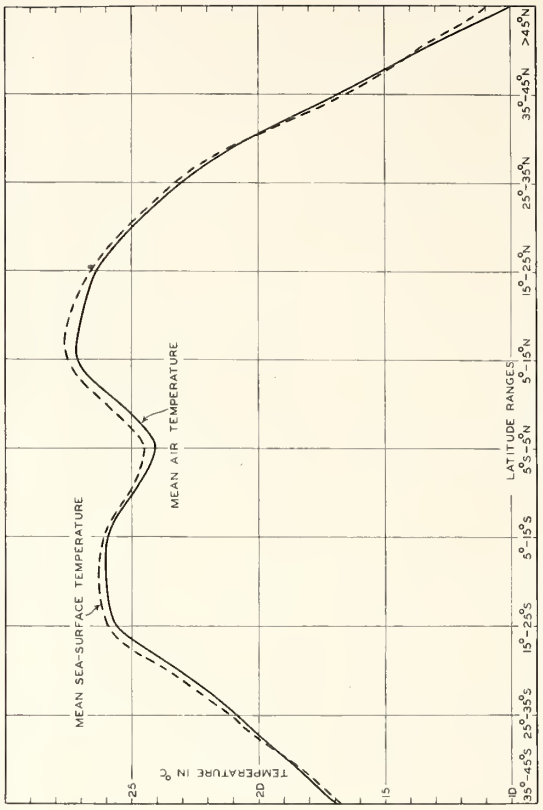


FIG. 14—MEAN AIR AND SEA-SURFACE TEMPERATURES FOR LATITUDE RANGES, FROM CARNEGIE RESULTS, 1928–1929

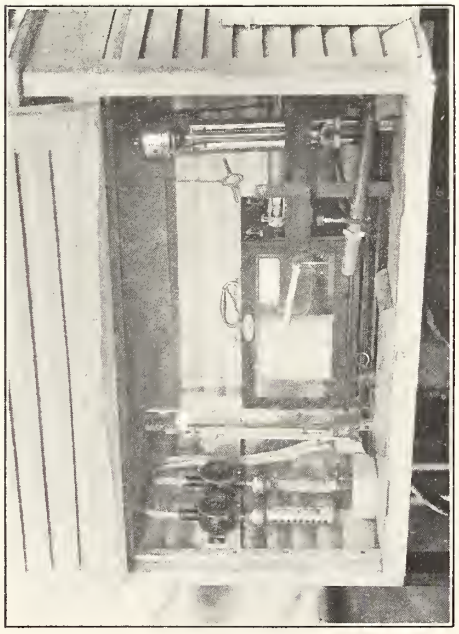


FIG. 11—THE STEVENSON SCREEN OPEN; LEFT, A PAIR OF WET- AND DRY-BULB HARTMANN AND BRAUN THERMOMETERS; CENTER, NEGRETTI-ZAMBRA VENTILATING RECORDING PSYCHROMETER, MOTOR-BOX OUTSIDE SHELTER; EXTREME RIGHT, ASSMANN ASPIRATION PSYCHROMETER

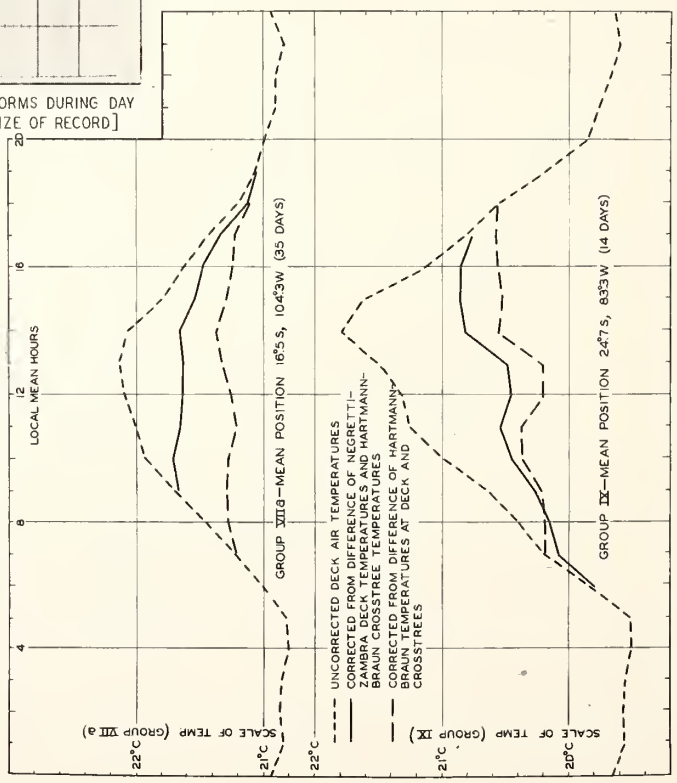


FIG. 13—RESULT OF CORRECTING FOR EXCESSIVE DAYTIME DECK TEMPERATURES BY MEANS OF DIURNAL VARIATION IN DIFFERENCES BETWEEN DECK AND CROSSTREES TEMPERATURES FROM CARNEGIE RESULTS

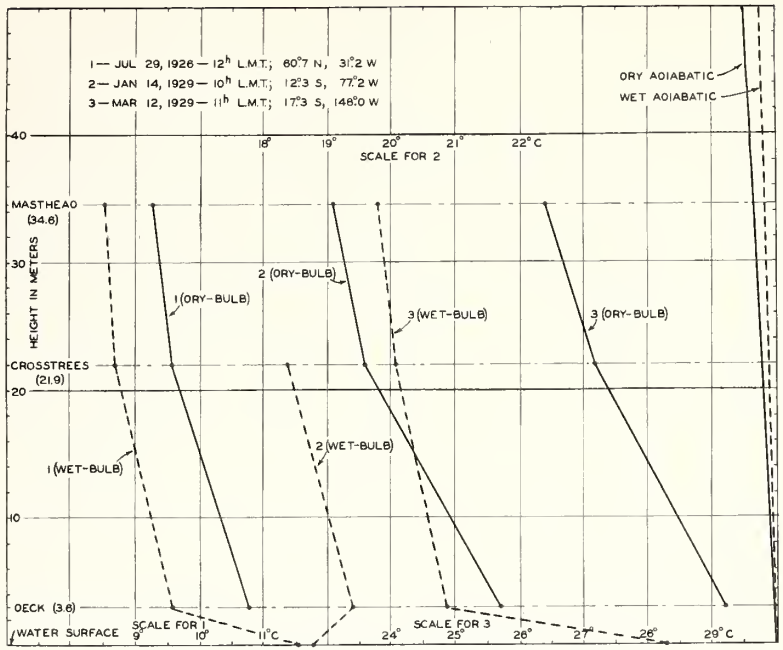


FIG. 15—WET- AND DRY-BULB LAPSE RATES, CARNEGIE RESULTS, 1928–1929

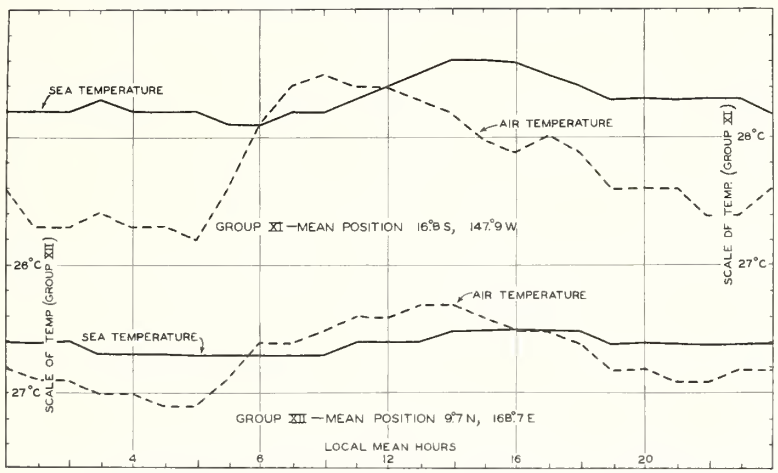


FIG. 17—TYPICAL DIURNAL CURVES OF AIR AND SEA TEMPERATURES FROM CARNEGIE RESULTS

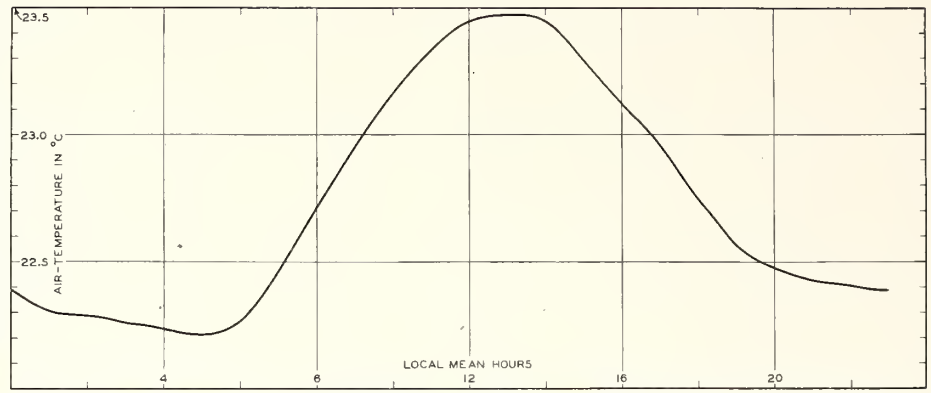


FIG. 16—DIURNAL VARIATION OF AIR TEMPERATURE, ALL DAYS, FROM CARNEGIE RESULTS, 1928–1929 (CORRECTED FOR NONCYCLIC CHANGE)

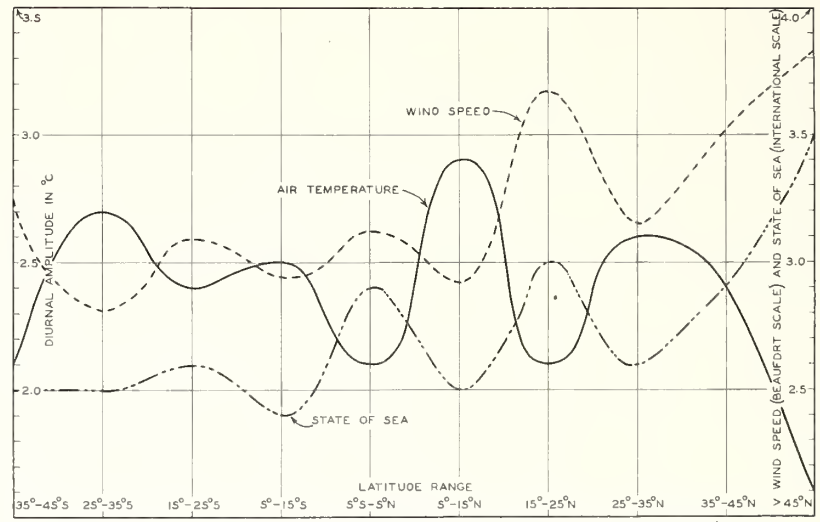


FIG. 18—DIURNAL AMPLITUDE OF AIR TEMPERATURE, WIND SPEED (MEAN BEAUFORT NUMBER), AND STATE OF SEA (MEAN INTERNATIONAL NUMBER) FOR LATITUDE RANGES, FROM CARNEGIE RESULTS, 1928–1929 [WIND AND STATE-OF-SEA DATA ARE FROM NOON (G.M.T) OBSERVATIONS]

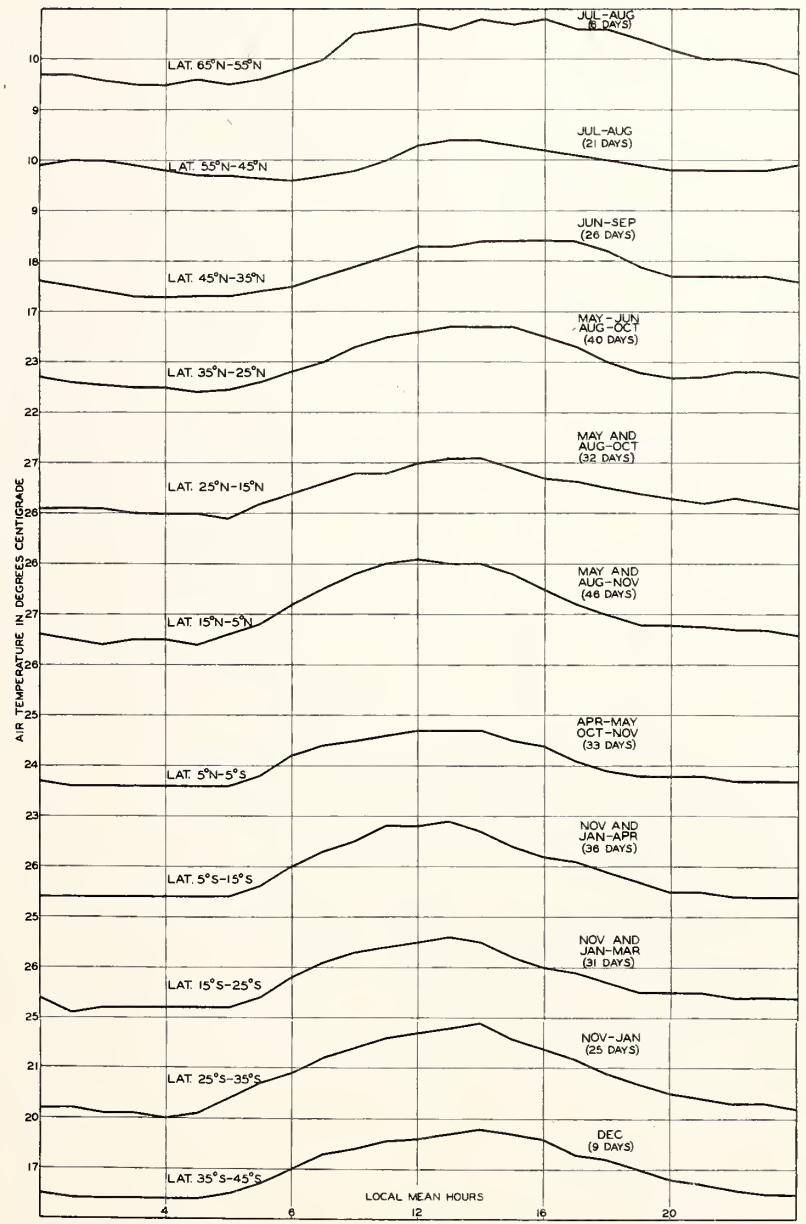


FIG. 19—MEAN DIURNAL COURSE OF AIR TEMPERATURE FOR MEAN LATITUDES OVER THE OCEANS, CARNEGIE RESULTS, 1928–1929

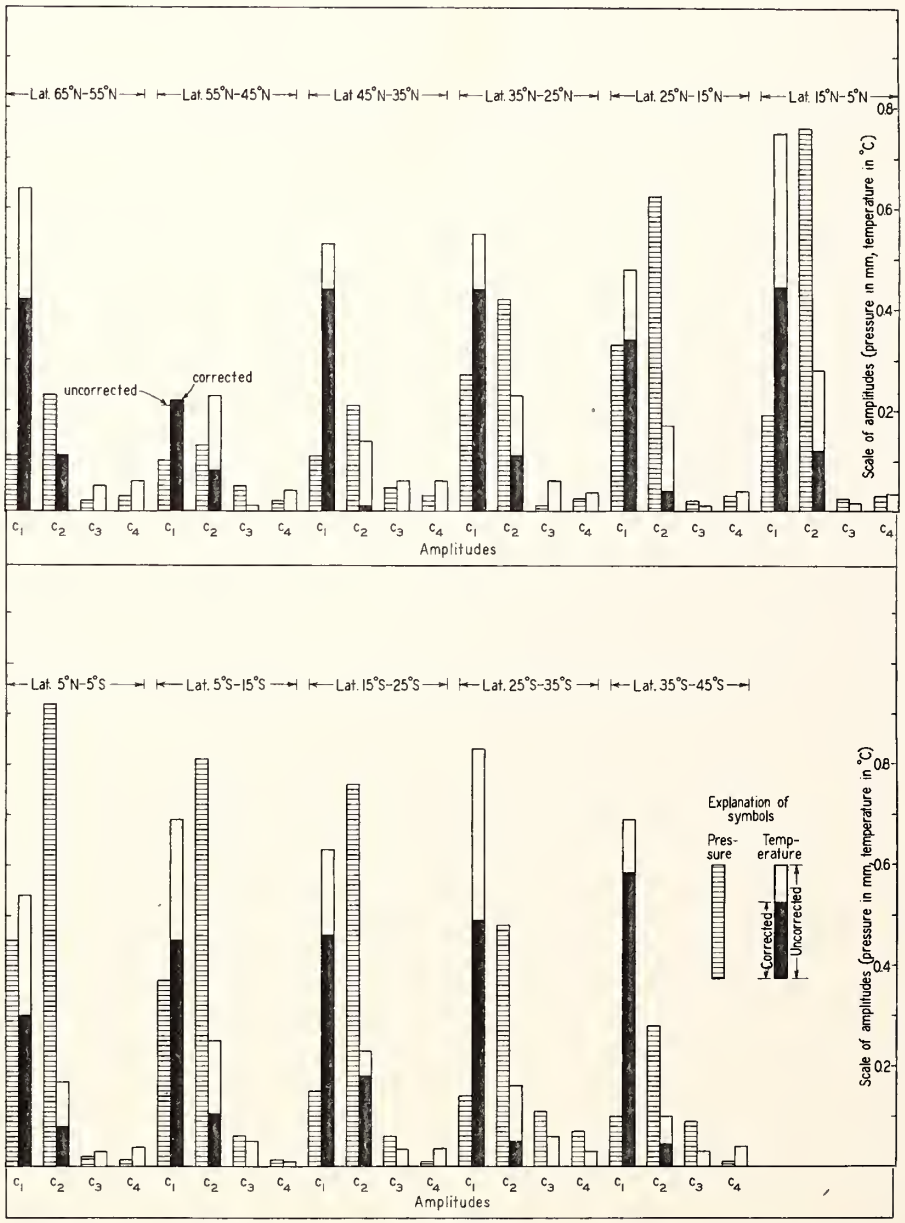


FIG. 20—AMPLITUDES OF HARMONIC OSCILLATIONS OF AIR PRESSURE AND OF AIR TEMPERATURE FOR 10°-LATITUDE ZONES, LATITUDES 65° NORTH TO 45° SOUTH, CARNEGIE RESULTS, 1928-1929

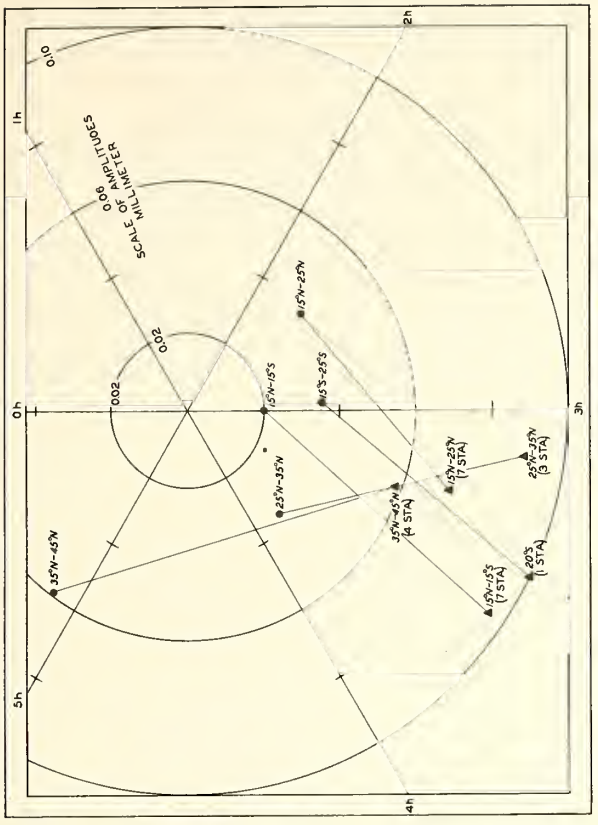


FIG 21—HARMONIC DIAL COMPARING 6-HOURLY VARIATION AIR TEMPERATURE FROM CARNEGIE RESULTS, 1928-1929, AND FROM MEAN OF COASTAL STATIONS AFTER PRAMANIK

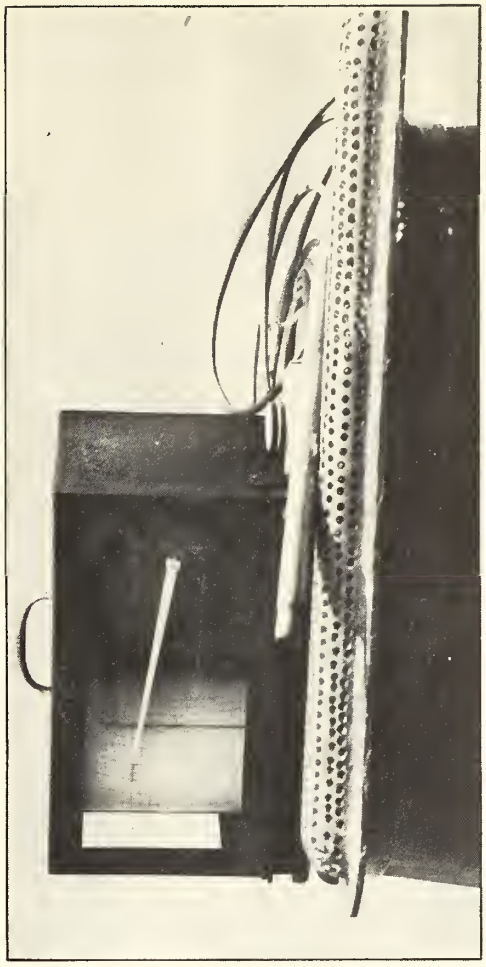


FIG. 22—SEA-WATER THERMOGRAPH USED ON THE CARNEGIE, CRUISE VII, SHOWING MERCURY BULB, METAL SHIELD, AND RECORDING MECHANISM

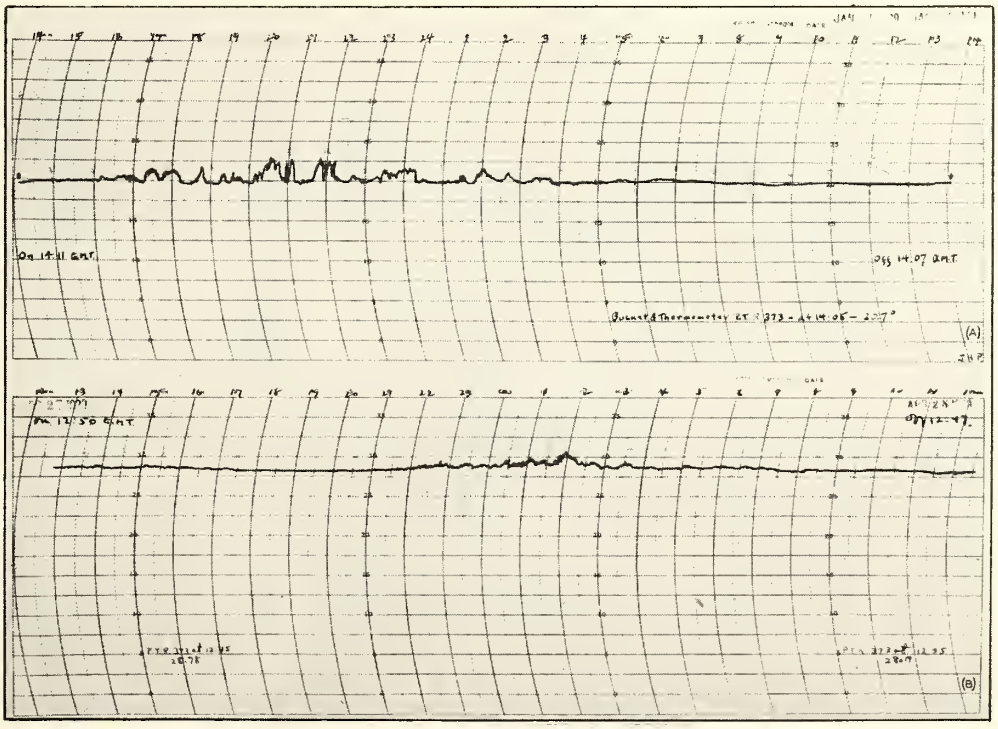


FIG. 23—SAMPLE THERMOGRAMS FROM CRUISE VII OF THE CARNEGIE; (A) OBTAINED ON THE WESTERN EDGE OF THE PERU CURRENT, (B) TYPICAL OF CALM, CLEAR DAYS IN THE TROPICS [REPRODUCTION IS ONE-THIRD SIZE OF RECORDS]

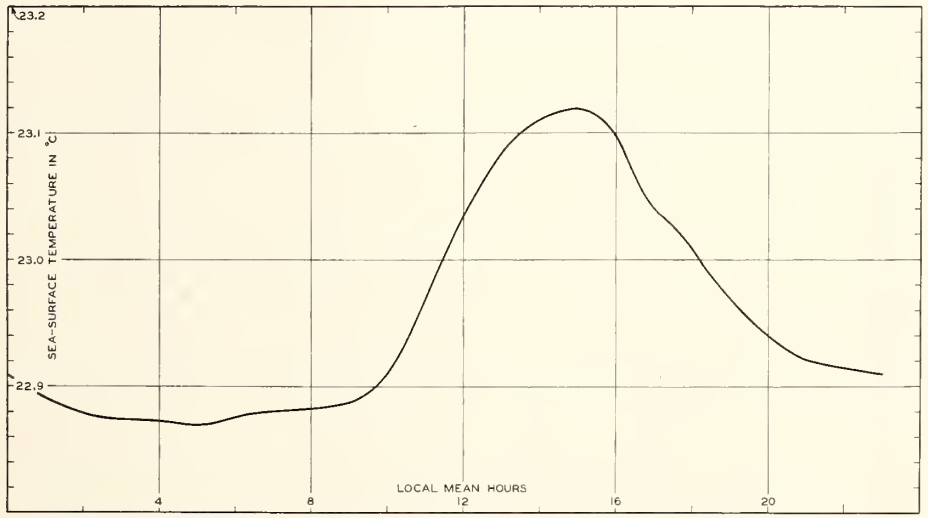


FIG. 24—DIURNAL VARIATION OF SEA-SURFACE TEMPERATURE, ALL DAYS, FROM CARNEGIE RESULTS, 1928–1929
(CORRECTED FOR NONCYCLIC CHANGE)

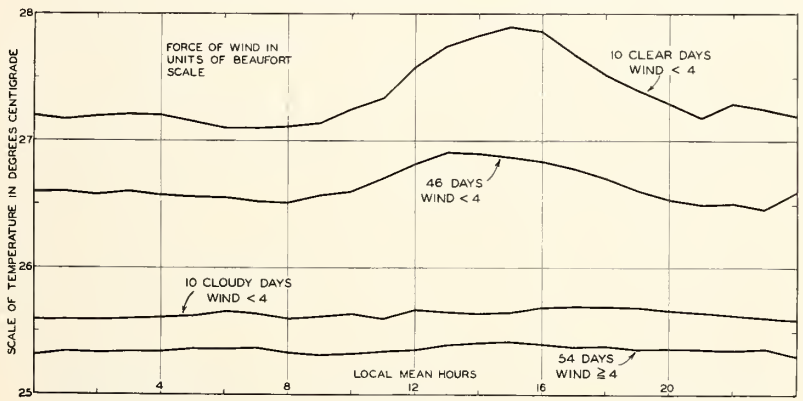


FIG. 25—COMPARISON OF MEAN DIURNAL COURSE OF SEA-SURFACE TEMPERATURE FOR CLEAR AND CLOUDY DAYS, AND FOR CALM AND WINDY DAYS, TROPICAL PACIFIC OCEAN, CARNEGIE RESULTS, 1928–1929

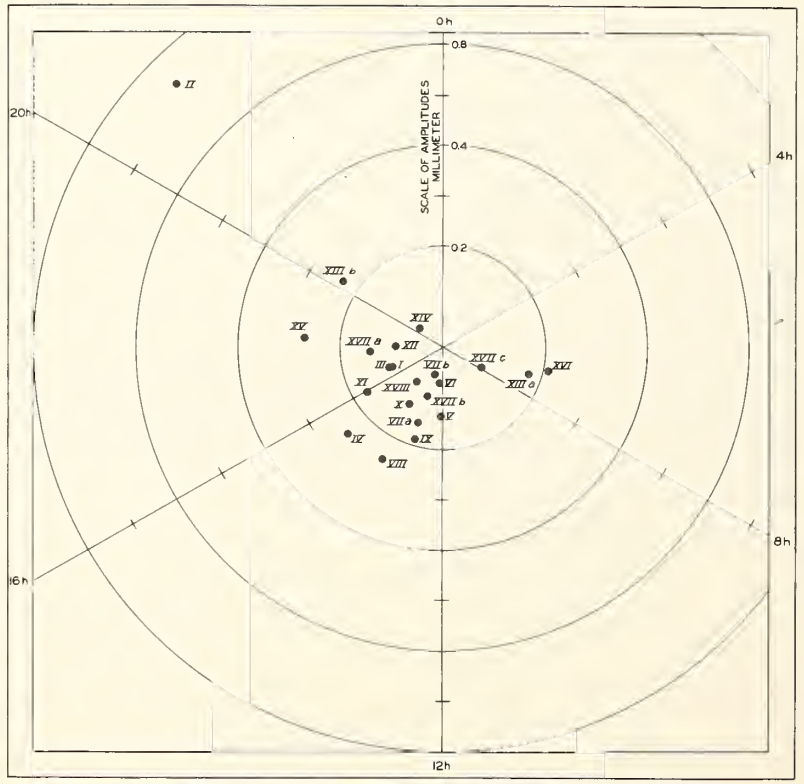


FIG. 26—HARMONIC DIAL OF 24-HOURLY VARIATION OF SEA-SURFACE TEMPERATURE FOR GROUPS I–XVIII, CARNEGIE RESULTS, 1928–1929

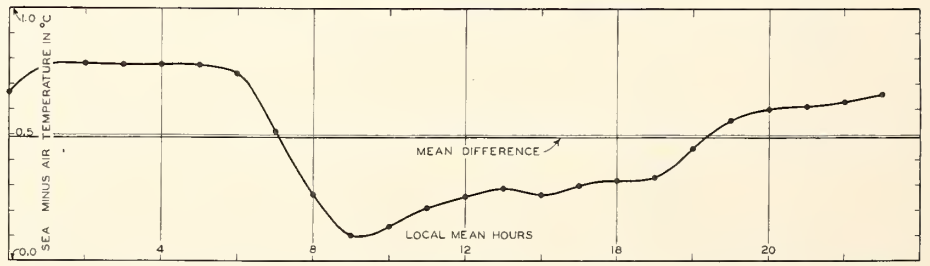
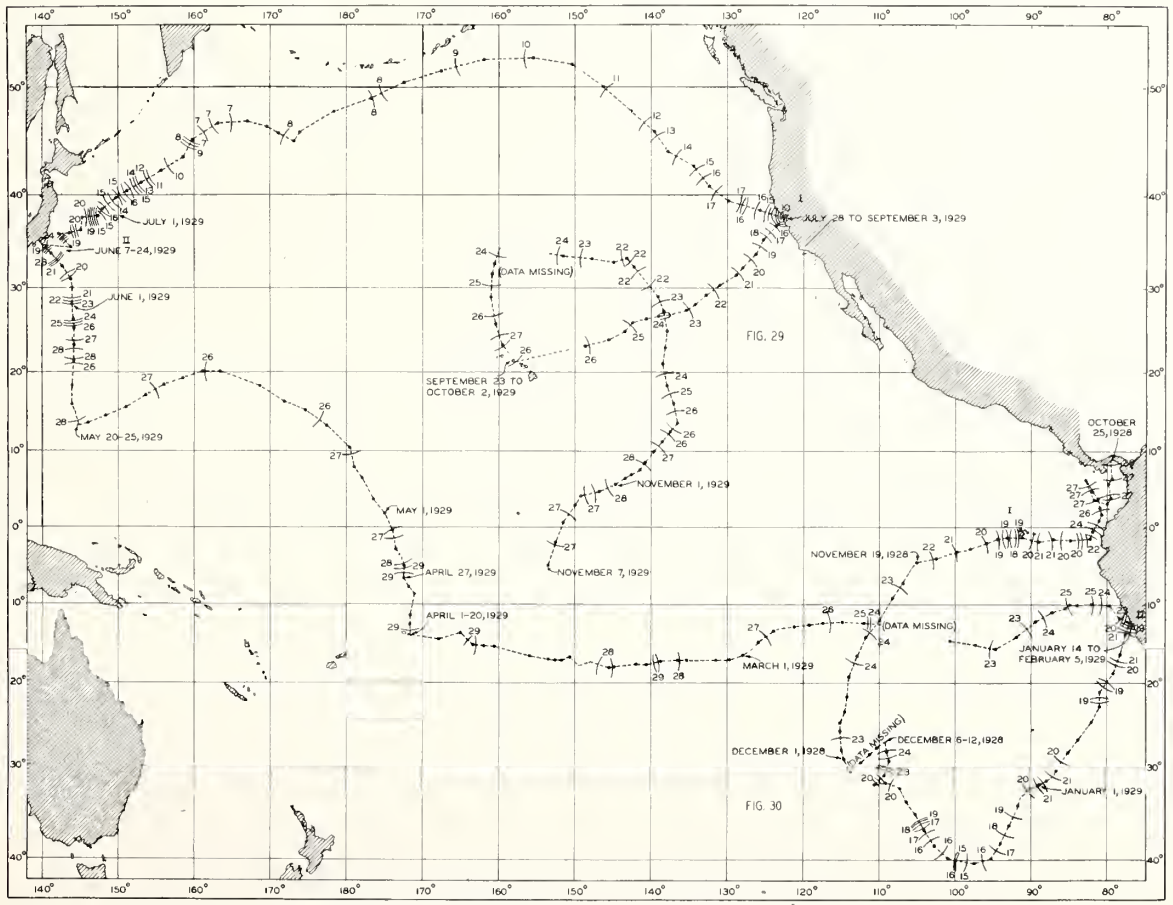


FIG. 27—DIURNAL VARIATION OF SEA MINUS AIR TEMPERATURES IN CARNEGIE GROUPS I TO XI (WEIGHTED MEANS)
[SEA TEMPERATURES CORRECTED FOR NONCYCLIC CHANGE; AIR TEMPERATURES CORRECTED FOR NONCYCLIC CHANGE AND RADIATION]

FIG. 28—SEA-SURFACE ISOTHERMS IN THE ATLANTIC, CARNEGIE RESULTS, 1928-1929



FIGS. 29 AND 30—SEA-SURFACE ISOTHERMS IN THE PACIFIC, CARNEGIE RESULTS, 1928-1929

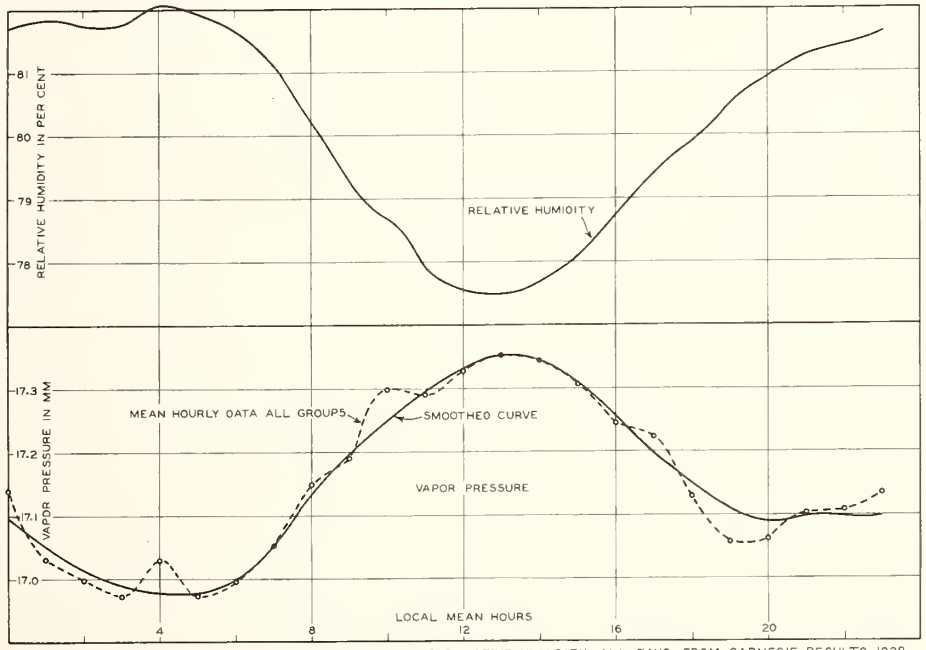


FIG. 31—DIURNAL VARIATION OF VAPOR PRESSURE AND RELATIVE HUMIDITY, ALL DAYS, FROM CARNEGIE RESULTS, 1928–1929 (CORRECTED FOR NONCYCLIC CHANGE)

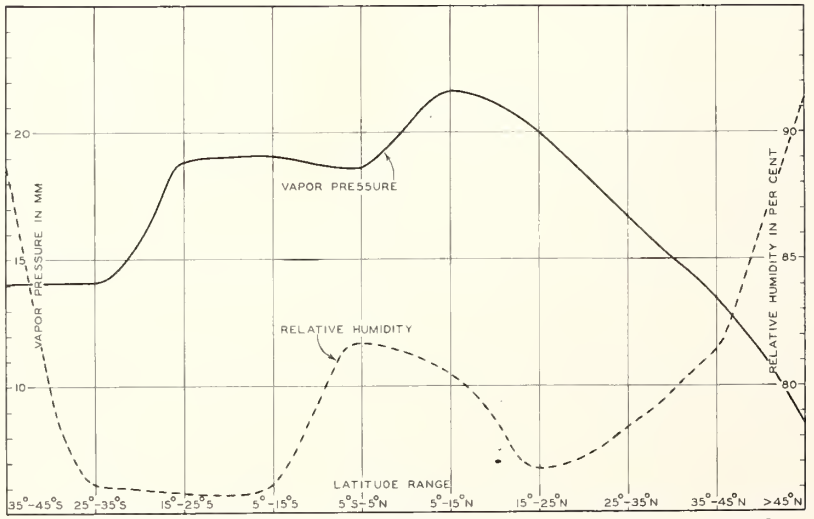


FIG. 32—MEAN VAPOR PRESSURE AND RELATIVE HUMIDITY FOR LATITUDE RANGES, FROM CARNEGIE RESULTS, 1928–1929

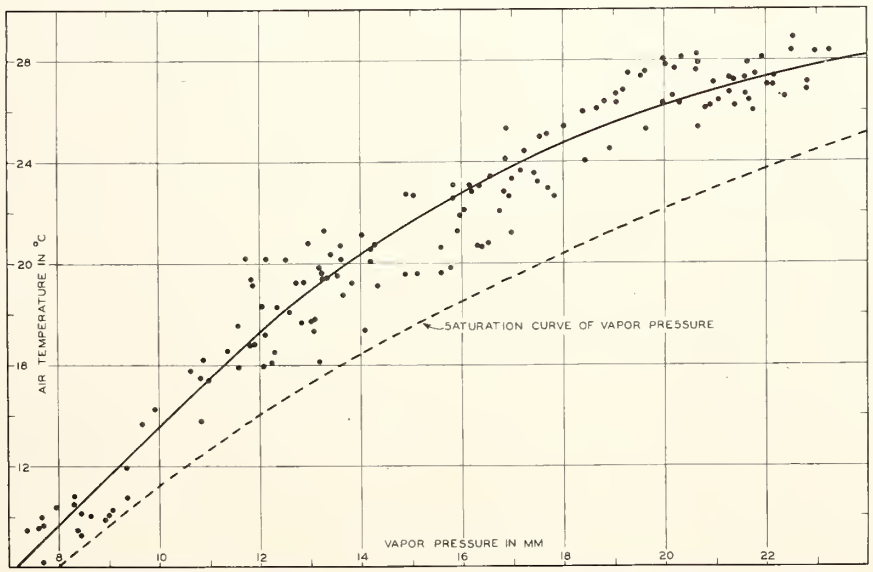


FIG. 34—VARIATION OF VAPOR PRESSURE WITH AIR TEMPERATURE, FROM CARNEGIE RESULTS, 1928–1929

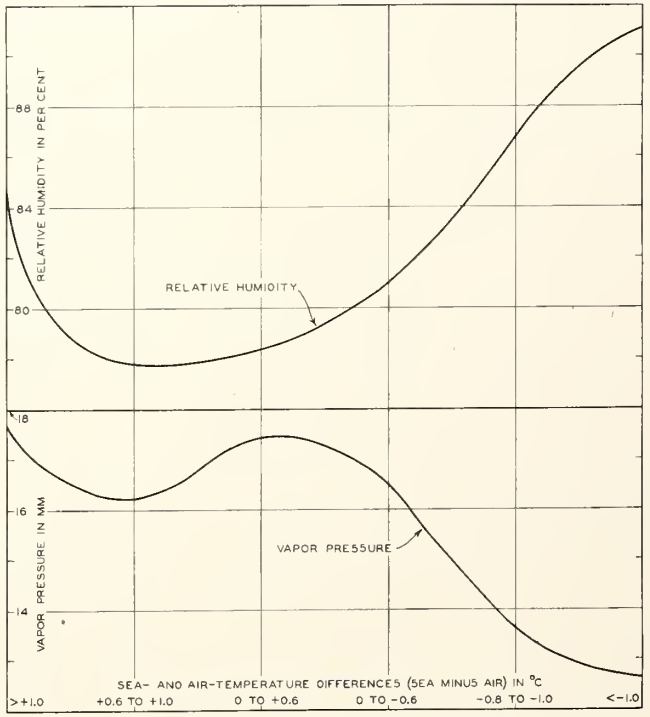


FIG. 33—VARIATION OF VAPOR PRESSURE AND RELATIVE HUMIDITY WITH SEA- AND AIR-TEMPERATURE DIFFERENCES (SEA MINUS AIR), FROM CARNEGIE RESULTS, 1928–1929

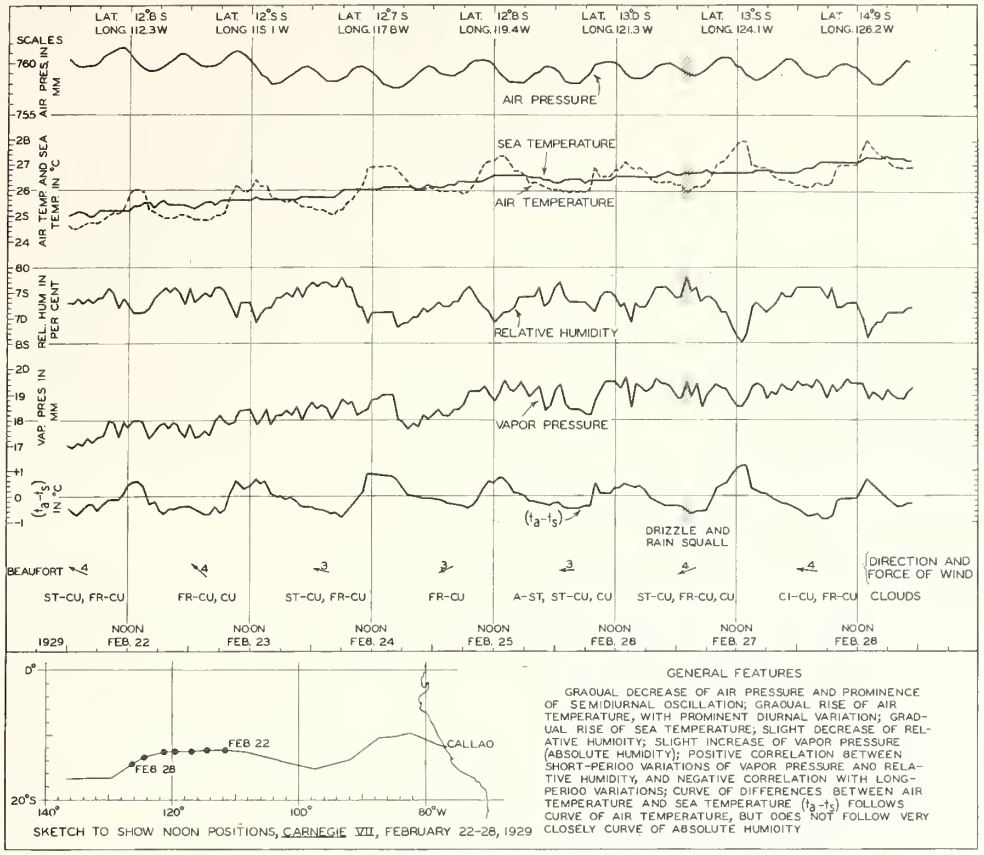


FIG.35—PROFILE OF METEOROLOGICAL CONDITIONS IN TROPICAL PACIFIC, CARNEGIE RESULTS, FEBRUARY 22—28, 1929

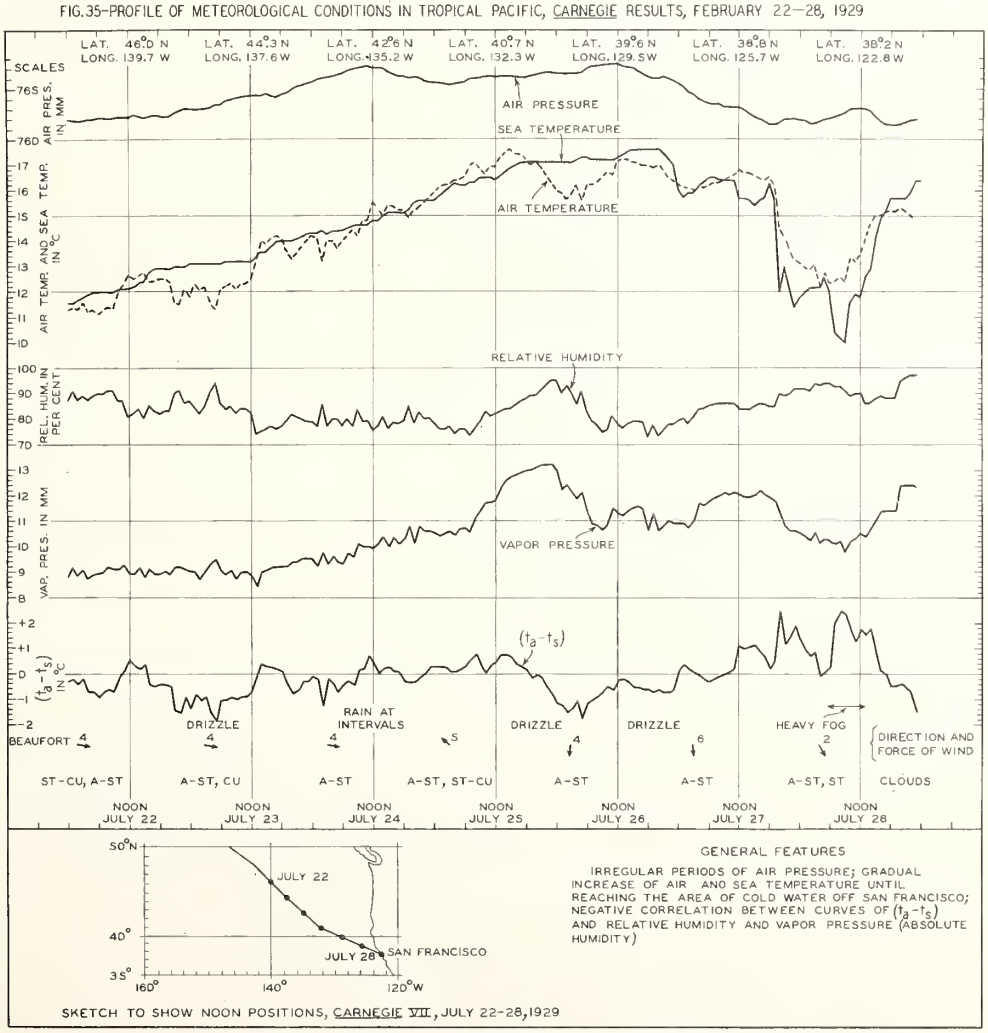


FIG. 36—PROFILE OF METEOROLOGICAL CONDITIONS IN NORTHEASTERN PACIFIC, CARNEGIE RESULTS, JULY 22—28, 1929

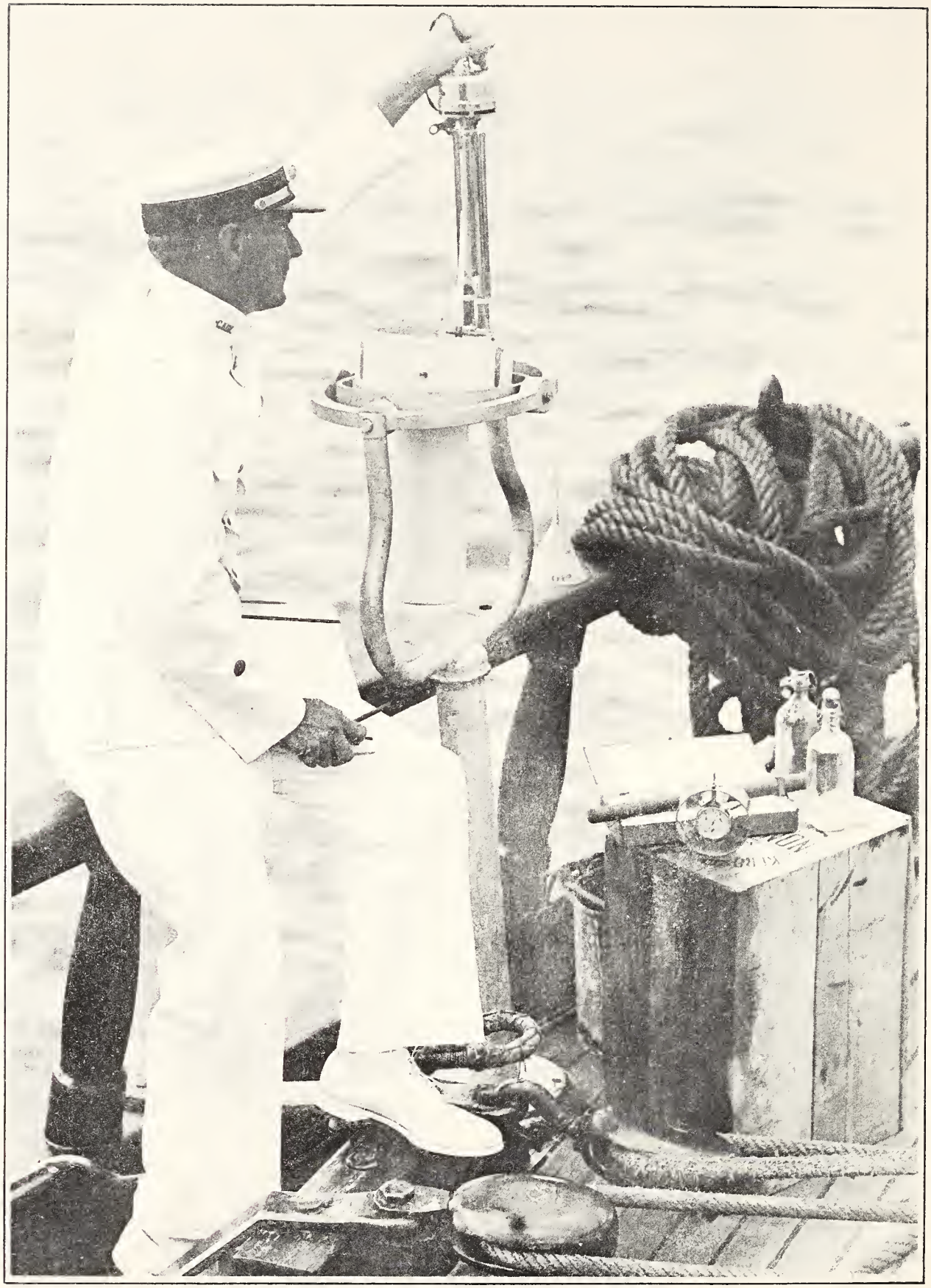
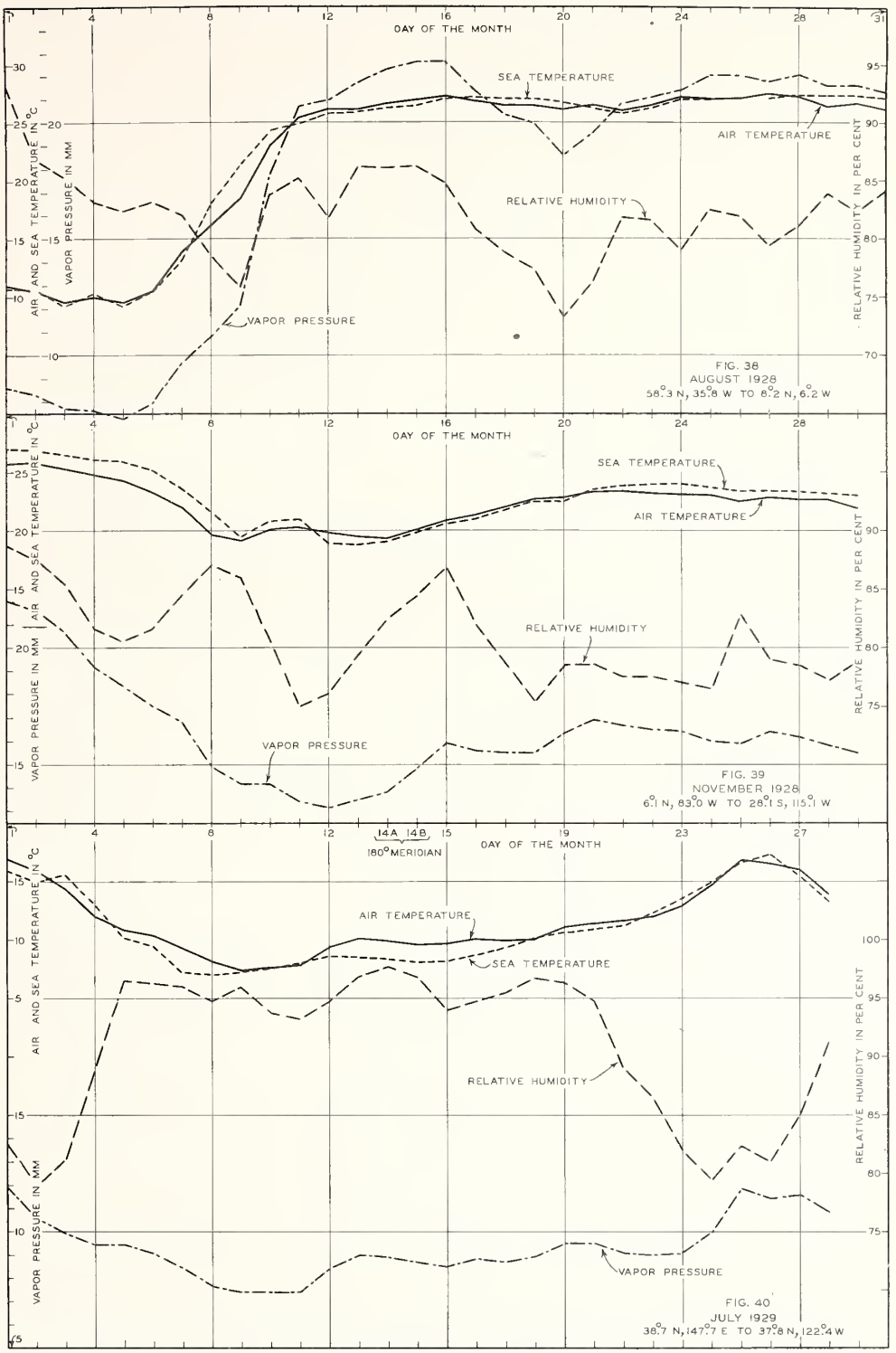
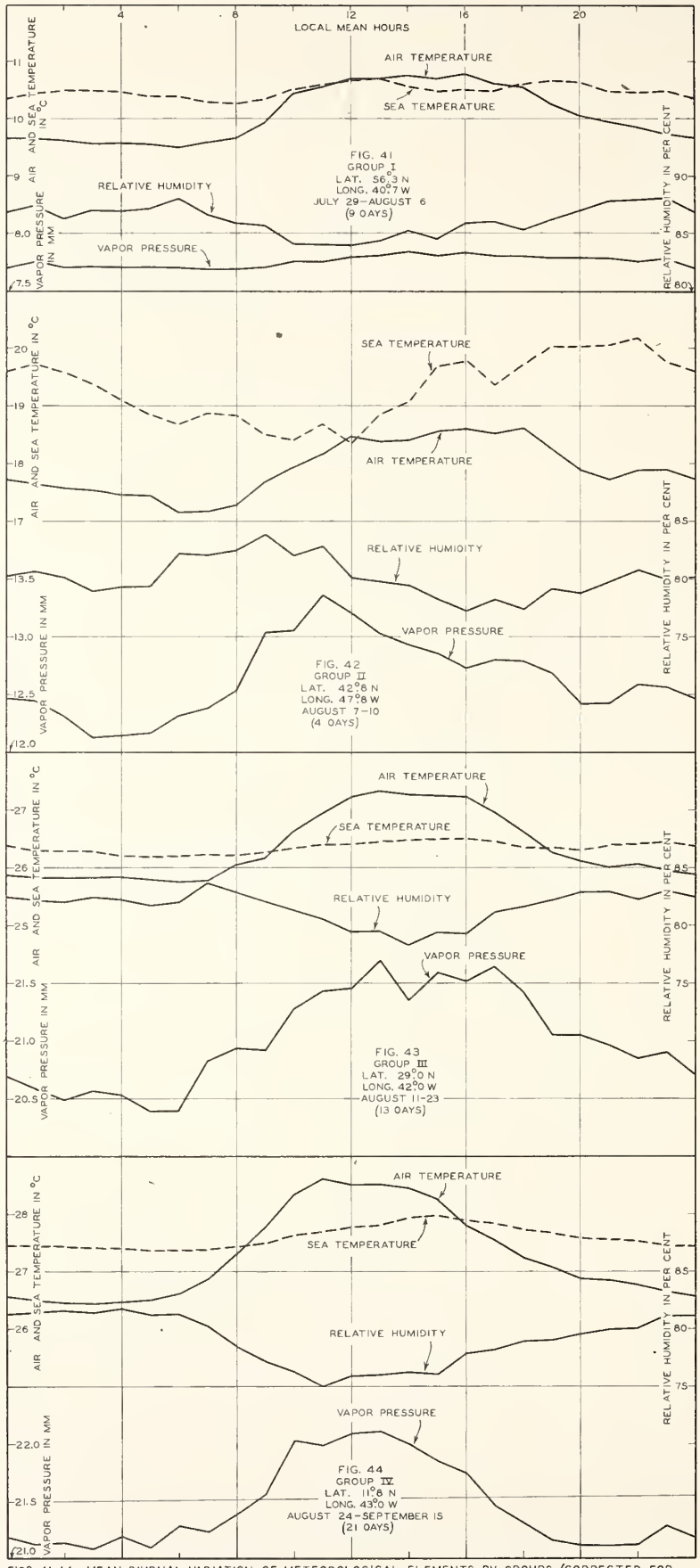


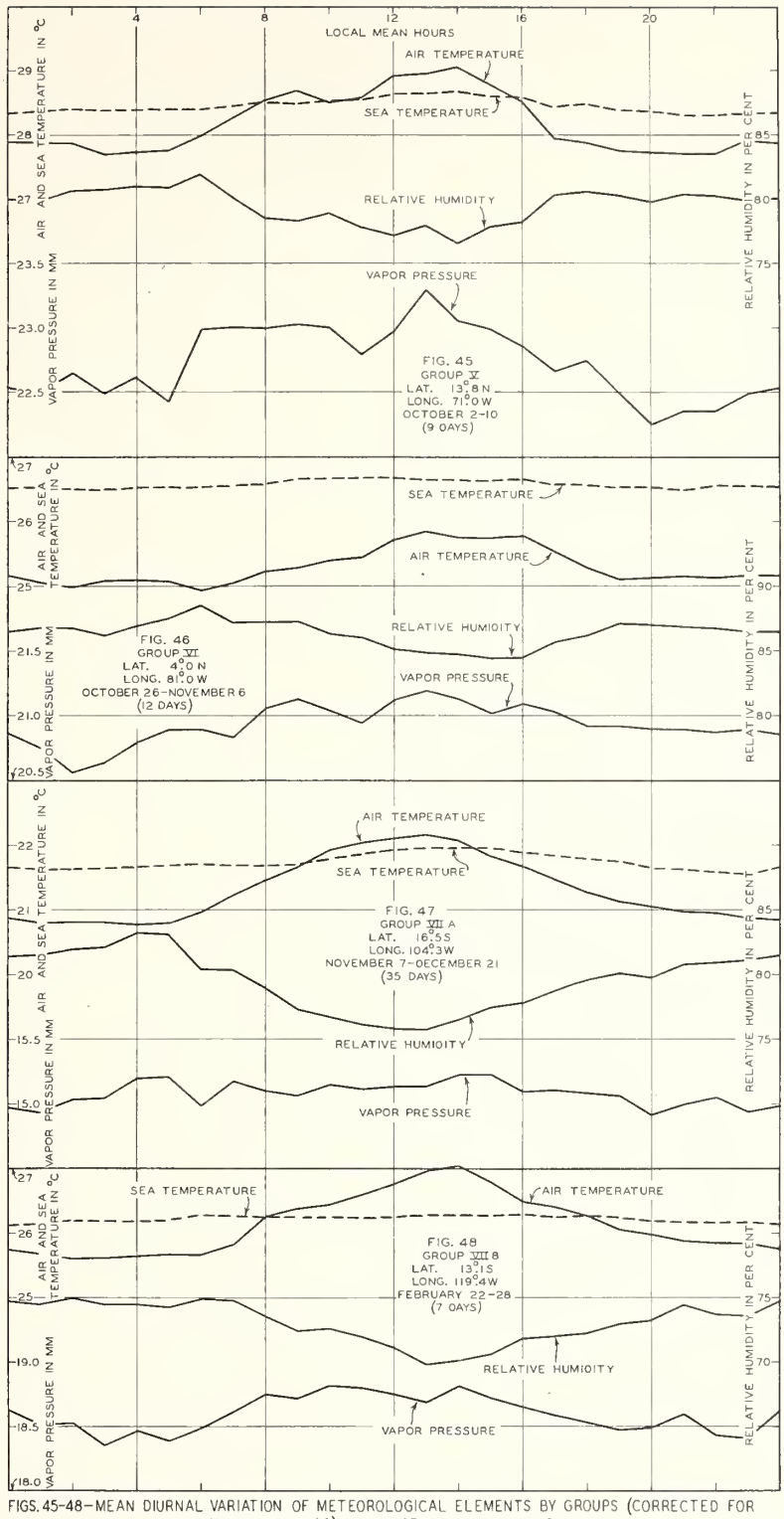
FIG. 37—TAKING MEASUREMENTS AT THE EVAPORIMETER ON THE CARNEGIE



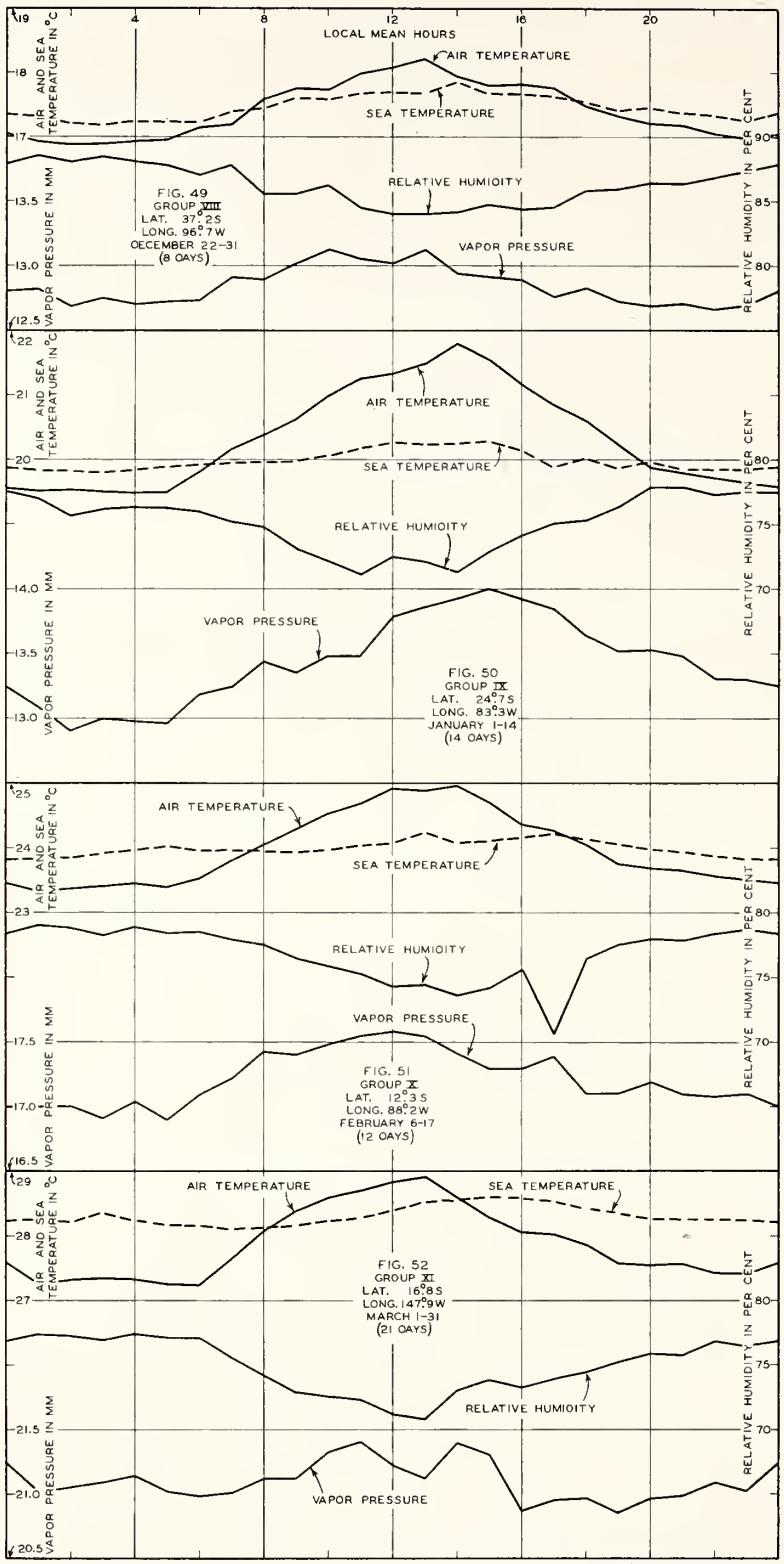
FIGS. 38-40—COMPARISON OF DAILY MEANS OF AIR AND SEA TEMPERATURES, RELATIVE HUMIDITY, AND VAPOR PRESSURE, FROM CARNEGIE RESULTS, 1928–1929



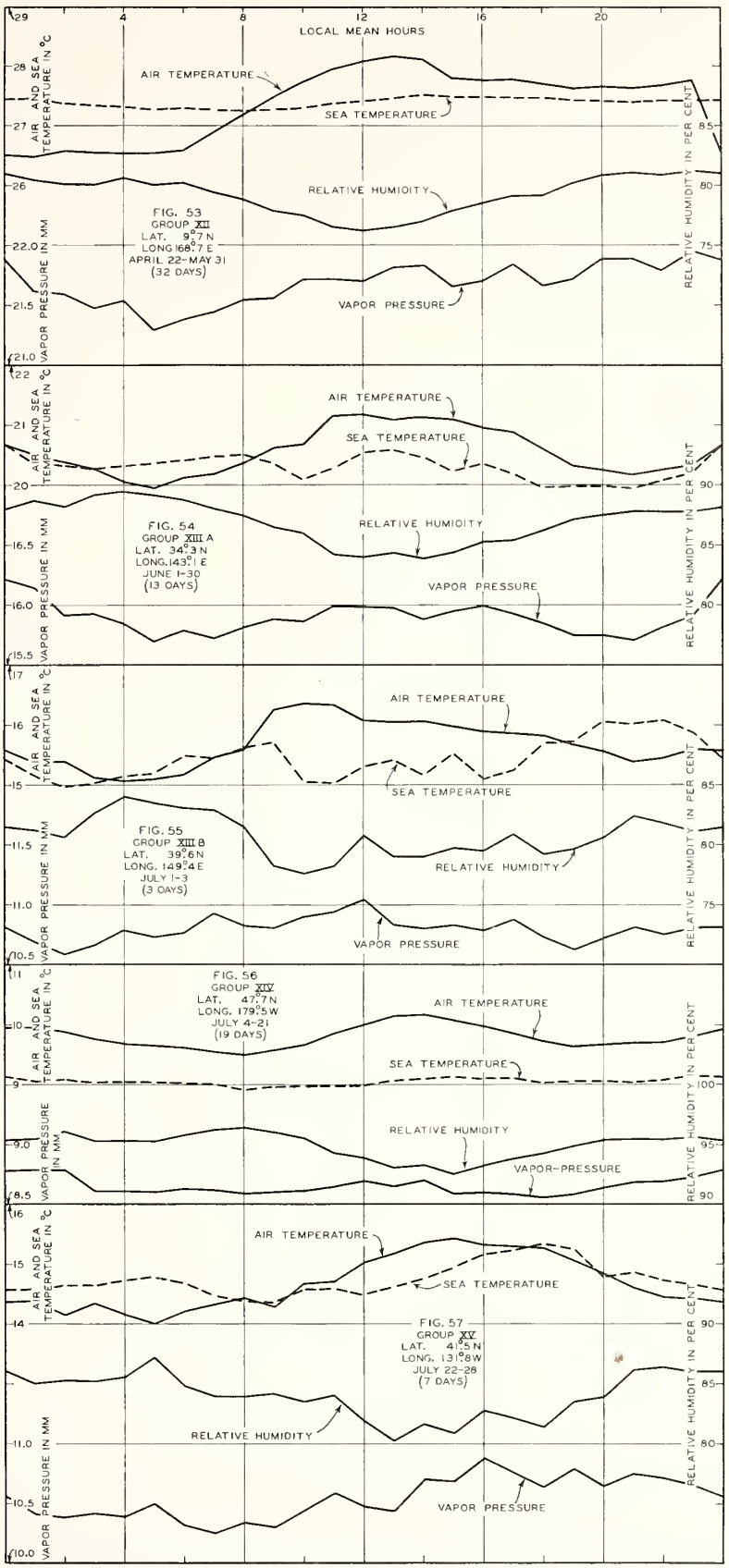
FIGS. 41-44—MEAN DIURNAL VARIATION OF METEOROLOGICAL ELEMENTS BY GROUPS (CORRECTED FOR NONCYCLIC CHANGE), FROM CARNEGIE RESULTS, 1928–1929



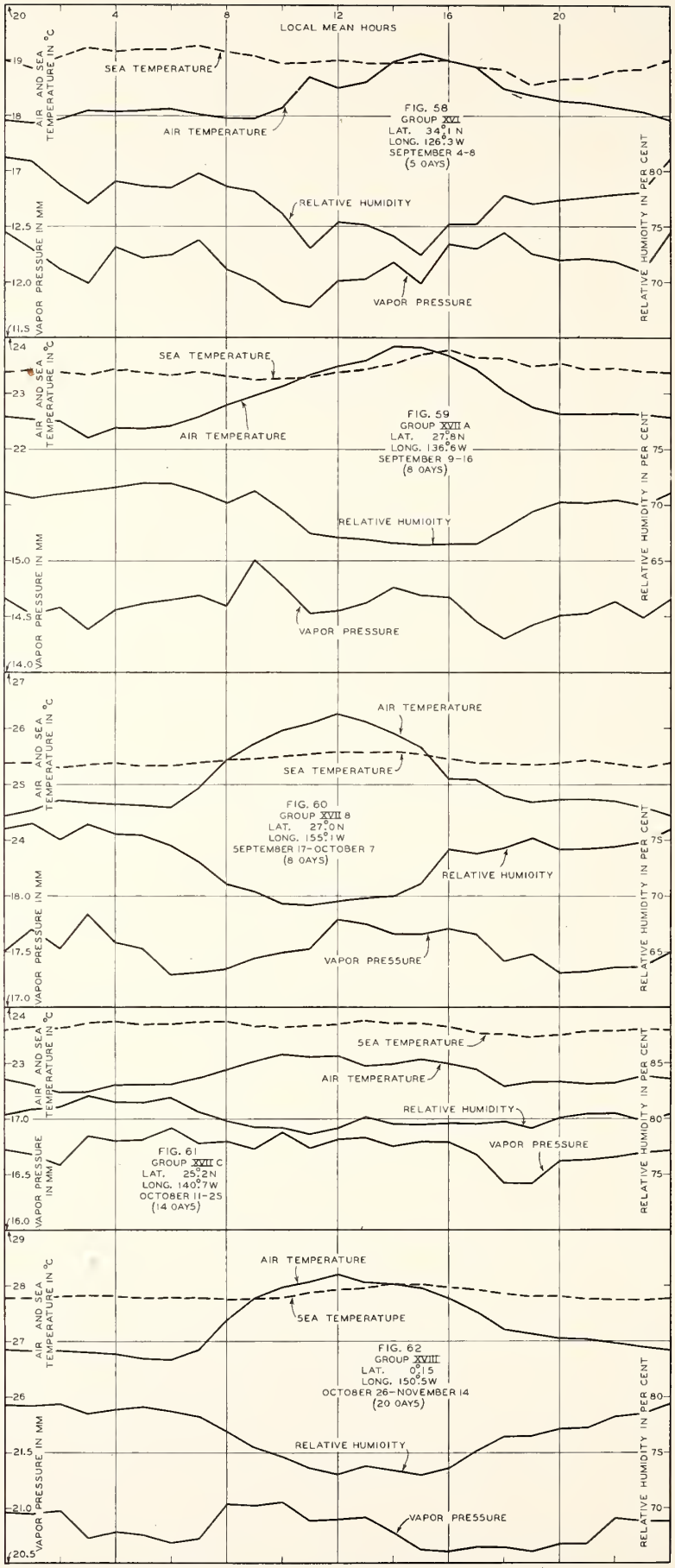
FIGS. 45-48—MEAN DIURNAL VARIATION OF METEOROLOGICAL ELEMENTS BY GROUPS (CORRECTED FOR NONCYCLIC CHANGE), FROM CARNEGIE RESULTS, 1928-1929



FIGS. 49-52—MEAN DIURNAL VARIATION OF METEOROLOGICAL ELEMENTS BY GROUPS (CORRECTED FOR NONCYCLIC CHANGE), FROM CARNEGIE RESULTS, 1928-1929



FIGS. 53-57—MEAN DIURNAL VARIATION OF METEOROLOGICAL ELEMENTS BY GROUPS (CORRECTED FOR NONCYCLIC CHANGE), FROM CARNEGIE RESULTS, 1928-1929



FIGS. 58–62—MEAN DIURNAL VARIATION OF METEOROLOGICAL ELEMENTS BY GROUPS (CORRECTED FOR NONCYCLIC CHANGE), FROM CARNEGIE RESULTS, 1928–1929

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